5.1 Air Quality

5.1.1 Introduction

The Applicant proposes to develop a solar energy project called the Ivanpah Solar Electric Generating System (Ivanpah SEGS). It will be located in southern California's Mojave Desert, near the Nevada border, to the west of Ivanpah Dry Lake. The project will be located in San Bernardino County, California, on federal land managed by the Bureau of Land Management (BLM). It will be constructed in three phases: two 100-megawatt (MW) phases (known as Ivanpah 1 and 2) and a 200-MW phase (Ivanpah 3). The phasing is planned so that Ivanpah 1 (the southernmost site) will be constructed first, followed by Ivanpah 2 (the middle site), then Ivanpah 3 (the 200-MW plant on the north), though the order of construction may change. Each 100-MW site requires about 850 acres (or 1.3 square miles); the 200-MW site is about 1,660 acres (or about 2.6 square miles). The total area required for all three phases, including the Administration/Operations and Maintenance building and substation, is approximately 3,400 acres. The Applicant has applied for a right-of-way grant for the land from BLM. Although this is a phased project, it is being analyzed as if all phases are operational.

The heliostat (or mirror) fields focus solar energy on the power tower receivers near the center of each of the heliostat arrays. (There are three arrays in the 100-MW plants and four arrays in the 200-MW plant). In each plant, one Rankine-cycle reheat steam turbine receives live steam from the solar boilers, and reheat steam from one solar reheater—located in the power block at the top of its own tower. The solar field and power generation equipment are started each morning after sunrise and insolation build-up, and shut down in the evening when insolation drops below the level required to keep the turbine online.

Natural gas fired boilers will be used to bring the systems up to operating temperature in the morning, and to keep system temperatures up during transient cloud cover. The boilers are not big enough to allow operation for sustained periods of reduced sunlight (i.e., on cloudy days or at night). Heat input from natural gas will not exceed 5 percent of the heat input from the sun, on an annual basis. Boiler use will not exceed four hours on any given day, and average boiler use will be less than one hour per operating day. Solar heat will be used to keep each boiler in hot standby mode, capable of responding to demand on short notice. No fuel will be fired while a boiler is on hot standby. To save water in the site's desert environment, each plant will use a dry-cooling condenser.

In addition, each plant will have a backup diesel fuel-fired engine to provide power to operate boiler feed, recirculation, and firewater pumps if power is otherwise unavailable.

This section describes existing air quality conditions and maximum potential impacts from construction and operation of the Ivanpah Solar Electric Generating System.

This section presents the methodology and results of the air quality analyses performed to assess potential impacts associated with air emissions from construction and operation of the Ivanpah SEGS. Potential public health risks posed by emissions of non-criteria pollutants are also addressed in Section 5.9 (Public Health).

Section 5.1.2 identifies the laws, ordinances, regulations, and standards (LORS) that can affect the project and project conformance. Section 5.1.3 presents the air quality setting, including geography, topography, climate, and meteorology. Section 5.1.4 provides an overview of air quality standards and health effects. Section 5.1.5 discusses the criteria pollutants and existing air quality in the vicinity of the proposed project. The affected environment is analyzed in Section 5.1.6, including the environmental consequences of emissions from the project and an overview of approaches for calculating facility impacts, modeling, and analysis. The screening health risk assessment, visibility screening analysis, and construction impacts analysis are also presented. A discussion of cumulative effects is presented in Section 5.1.7. Mitigation for project air quality impacts is discussed in Section 5.1.8. Section 5.1.9 identifies the air quality regulatory agencies relevant to the project, and Section 5.1.10 lists the required Air Permits and the schedule for their issuance. A list of references used in preparing the section is provided in Section 5.1.11.

5.1.2 Laws, Ordinances, Regulations, and Standards

Requirements of federal, state, and local jurisdictions are discussed in Sections 5.1.2.1, 5.1.2.2, and 5.1.2.3, respectively. Compliance with each of these requirements is also addressed.

5.1.2.1 Federal LORS

The U.S. Environmental Protection Agency (EPA) implements and enforces the requirements of many of the federal environmental laws. EPA Region 9, which has its offices in San Francisco, administers federal air programs in California. The federal Clean Air Act, as most recently amended in 1990, provides EPA with the legal authority to regulate air pollution from stationary sources such as Ivanpah. EPA has promulgated the following stationary source regulatory programs to implement the requirements of the federal Clean Air Act:

- Prevention of Significant Deterioration (PSD)
- New Source Review (NSR)
- Title IV: Acid Rain Program
- Title V: Operating Permits
- National Standards of Performance for New Stationary Sources (NSPS)
- National Emission Standards for Hazardous Air Pollutants (NESHAPs)

5.1.2.1.1 Prevention of Significant Deterioration Program

Authority: Clean Air Act §160-169A, 42 USC §7470-7491; 40 CFR Parts 51 and 52

Requirements: Requires pre-construction review and permitting of new or modified major stationary sources of air pollution to prevent significant deterioration of ambient air quality. PSD applies to pollutants for which ambient concentrations do not exceed the corresponding National Ambient Air Quality Standards (NAAQS) (i.e., attainment pollutants). The PSD program allows new sources of air pollution to be constructed, or existing sources to be modified, while preserving the existing ambient air quality levels, protecting public health and welfare, and protecting Class I areas (e.g., national parks and wilderness areas). Although this program is normally implemented at the local level with federal oversight, it is presently implemented in the Mojave Desert Air Quality Management District (MDAQMD) by EPA Region 9.

As discussed in more detail below, the Ivanpah facility is not a major stationary source. Hence, the Ivanpah SEGS is not subject to the PSD program.

Administering Agency: EPA Region 9.

5.1.2.1.2 New Source Review

Authority: Clean Air Act §171-193, 42 USC §7501 et seq.; 40 CFR Parts 51 and 52

Requirement: Requires pre-construction review and permitting of new or modified major stationary sources of air pollution to allow industrial growth without interfering with the attainment and maintenance of NAAQS. New source review jurisdiction has been delegated to the MDAQMD.

Administering Agency: MDAQMD.

5.1.2.1.3 Acid Rain Program

Authority: Clean Air Act §401 (Title IV), 42 USC §7651

Requirement: Requires the monitoring and reporting of emissions of acidic compounds and their precursors. The principal source of these compounds is the combustion of fossil fuels. Therefore, Title IV established national standards to monitor, record, and in some cases limit emissions of sulfur dioxide (SO_2) and oxides of nitrogen (NO_x) from electrical power generating facilities. These standards are implemented at the local level with federal oversight.

Title IV applies to the Ivanpah SEGS, because the boilers are affected units (they combust fuel, and they provide heat to a power generating facility with a nameplate capacity greater than 25 MW).

Administering Agency: MDAQMD, with EPA Region 9 oversight.

5.1.2.1.4 Title V Operating Permits Program

Authority: Clean Air Act §501 (Title V), 42 USC §7661

Requirements: Requires the issuance of operating permits that identify all applicable federal performance, operating, monitoring, recordkeeping, and reporting requirements. Title V applies to major facilities, Phase II Acid Rain facilities, subject solid waste incinerator facilities, and any facility listed by EPA as requiring a Title V permit. EPA has delegated authority for this program to MDAQMD.

As discussed below, emissions from the Ivanpah SEGS are below Title V applicability thresholds. However, the project is subject to the Acid Rain program. Therefore, the Ivanpah SEGS is subject to the Title V Operating Permits Program.

Administering Agency: MDAQMD, with EPA Region 9 oversight.

5.1.2.1.5 National Standards of Performance for New Stationary Sources

Authority: Clean Air Act §111, 42 USC §7411; 40 CFR Part 60

Requirements: Establishes standards of performance to limit the emission of criteria pollutants (air pollutants for which EPA has established NAAQS) from new or modified facilities in specific source categories. These standards are implemented at the local level with federal oversight. The applicability of these regulations depends on the equipment size, process rate, and/or the date of construction, modification, or reconstruction of the affected facility. NSPS Subpart Da, Standards of Performance for Boilers, is applicable to the Ivanpah 3 boiler. NSPS Subpart IIII, Standards of Performance for Stationary Compression Ignition Internal Combustion Engines, is applicable to the emergency engines and the fire pump engines.

Administering Agency: MDAQMD, with EPA Region 9 oversight.

5.1.2.1.6 National Emission Standards for Hazardous Air Pollutants

Authority: Clean Air Act §112, 42 USC §7412

Requirements: Establishes national emission standards to limit emissions of hazardous air pollutants (HAPs, or air pollutants identified by EPA as causing or contributing to the adverse health effects of air pollution, but for which NAAQS have not been established) from major sources of HAPs in specific source categories.[1] These standards are implemented at the local level with federal oversight.

As discussed below, the Ivanpah SEGS is not a major source of HAPS. Therefore the Ivanpah SEGS is not subject to NESHAPs.

Administering Agency: MDAQMD, with EPA Region 9 oversight.

5.1.2.1.7 Consistency with Federal Requirements

The MDAQMD has been delegated authority by the EPA to implement and enforce most federal requirements that are applicable to the project, including new source performance standards and new source review for nonattainment pollutants. Compliance with the MDAQMD regulations assures compliance and consistency with the corresponding federal requirements as well. The project would also be required to comply with the Federal Acid Rain requirements (Title IV). Because the MDAQMD is delegated authority to implement Title IV through its Title V permit program, the Ivanpah Title V Federal Operating Permit would include the necessary requirements for compliance with the Title IV Acid Rain provisions.

5.1.2.2 State LORS

The California Air Resources Board (CARB) was created in 1968 by the Mulford-Carrell Air Resources Act, through the merger of two other state agencies. CARB's primary responsibilities are to develop, adopt, implement, and enforce the state's motor vehicle pollution control program; to administer and coordinate the state's air pollution research program; to adopt and update, as necessary, the California Ambient Air Quality Standards (CAAQS); to review the operations of the local air pollution control districts (APCDs); and to review and coordinate preparation of the SIP for achievement of the NAAQS. CARB has implemented the following state or federal stationary source regulatory programs in

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[1] A major source of HAPs is one that emits more than 10 tons per year (tpy) of any individual HAP, or more than 25 tpy of all HAPs combined.

accordance with the requirements of the federal Clean Air Act and California Health and Safety Code (H&SC):

- State Implementation Plan
- California Clean Air Act
- Toxic Air Contaminant Program
- Airborne Toxic Control Measure for Stationary Compression-Ignition Engines
- Nuisance Regulation
- Air Toxics "Hot Spots" Act
- California Energy Commission (CEC) and CARB Memorandum of Understanding

5.1.2.2.1 State Implementation Plan

Authority: H&SC §39500 et seq.

Requirements: The State Implementation Plan (SIP) demonstrates the means by which all areas of the state will attain and maintain NAAQS within the federally mandated deadlines, as required by the federal Clean Air Act. CARB reviews and coordinates preparation of the SIP. Local districts must adopt new rules or revise existing rules to demonstrate that the resulting emission reductions, in conjunction with reductions in mobile source emissions, will result in attainment of the NAAQS. The relevant MDAQMD Rules and Regulations that have also been incorporated into the SIP are discussed with the local LORS in Section 5.1.2.3.

Administering Agency: MDAQMD, with CARB and EPA Region 9 oversight.

5.1.2.2.2 California Clean Air Act

Authority: H&SC §40910 – 40930

Requirements: Established in 1989, the California Clean Air Act requires local districts to attain and maintain both national and state ambient air quality standards at the "earliest practicable date." Local districts must prepare air quality plans demonstrating the means by which the ambient air quality standards will be attained and maintained. The relevant components of the MDAQMD Air Quality Plan are discussed with the local LORS.

Administering Agency: MDAQMD, with CARB oversight.

5.1.2.2.3 Toxic Air Contaminant Program

Authority: H&SC §39650 – 39675

Requirements: Established in 1983, the Toxic Air Contaminant Identification and Control Act created a two-step process to identify toxic air contaminants (TACs) and control their emissions. CARB identifies and prioritizes the pollutants to be considered for identification as toxic air contaminants. CARB assesses the potential for human exposure to a substance, while the Office of Environmental Health Hazard Assessment evaluates the corresponding health effects. Both agencies collaborate in the preparation of a risk assessment report, which concludes whether a substance poses a significant health risk and should be identified as a toxic air contaminant. In 1993, the Legislature amended the program to include the federally identified HAPs as toxic air contaminants. CARB reviews the emission sources of an identified toxic air contaminant and, if necessary, develops air toxics control measures to reduce the emissions.

Administering Agency: CARB

5.1.2.2.4 Airborne Toxic Control Measure for Stationary Compression-Ignition Engines

Authority: Title 17, California Code of Regulations, §93115

Requirements: The purpose of the airborne toxic control measure (ATCM) is to reduce diesel particulate matter (DPM) and criteria pollutant emissions from stationary diesel-fueled compression ignition engines. The ATCM applies to stationary compression-ignition engines with a rating greater than 50 brake horsepower. The ATCM requires the use of CARB-certified diesel fuel or equivalent, and limits emissions from, and operations of, compression ignition engines.

Administering Agency: MDAQMD and CARB

5.1.2.2.5 Nuisance Regulation

Authority: CA Health and Safety Code §41700

Requirements: Provides that "no person shall discharge from any source whatsoever such quantities of air contaminants or other material which causes injury, detriment, nuisance, or annoyance to any considerable number of persons or to the public or which endanger the comfort, repose, health, or safety of any such persons or the public, or which cause, or have a natural tendency to cause injury or damage to business or property."

Administering Agency: MDAQMD and CARB

5.1.2.2.6 Air Toxic "Hot Spots" Act

Authority: H& SC §44300-44384; 17 CCR §93300-93347

Requirements: Established in 1987, the Air Toxics "Hot Spots" Information and Assessment Act supplements the toxic air contaminant program, by requiring the development of a statewide inventory of air toxics emissions from stationary sources. The program requires affected facilities to prepare (1) an emissions inventory plan that identifies relevant air toxics and sources of air toxics emissions; (2) an emissions inventory report quantifying air toxics emissions; and (3) a health risk assessment, if necessary, to characterize the health risks to the exposed public. Facilities whose air toxics emissions are deemed to pose a significant health risk must issue notices to the exposed population. In 1992, the Legislature amended the program to further require facilities whose air toxics emissions are deemed to pose a significant health risk to implement risk management plans to reduce the associated health risks. This program is implemented at the local level with state oversight.

Administering Agency: MDAQMD with CARB oversight.

5.1.2.2.7 CEC and CARB Memorandum of Understanding

Authority: CA Pub. Res. Code §25523(a); 20 CCR §1752, 1752.5, 2300-2309 and Div. 2, Chap. 5, Art. 1, Appendix B, Part (k)

Requirements: Provides for the inclusion of requirements in the CEC's decision on an Application For Certification (AFC) to assure protection of environmental quality; thus the AFC is required to include information concerning air quality protection.

Administering Agency: CEC

5.1.2.2.8 Consistency with State Requirements

As discussed in Section 5.1.2.3, state law set up local air pollution control districts and air quality management districts with the principal responsibility for regulating emissions from stationary sources. The Ivanpah SEGS is under the local jurisdiction of the MDAQMD, and compliance with MDAQMD regulations will assure compliance with state air quality requirements.

5.1.2.3 Local LORS

When the state's air pollution statutes were reorganized in the mid-1960s, local districts were required to be established in each county of the state. There are three different types of districts: county, regional (including the MDAQMD), and unified. In addition, special air quality management districts (AQMDs), with more comprehensive authority over non-vehicular sources, as well as transportation and other regional planning responsibilities, have been established by the Legislature for several regions in California. Local districts have principal responsibility to do the following:

- Develop plans for meeting the NAAQS and California ambient air quality standards;
- Develop control measures for non-vehicular sources of air pollution necessary to achieve and maintain both state and federal air quality standards;
- Implement permit programs established for the construction, modification, and operation of sources of air pollution;
- Enforce air pollution statutes and regulations governing non-vehicular sources; and
- Develop programs to reduce emissions from indirect sources.

Under the regulations that govern new sources of emissions, the project is required to secure a preconstruction Determination of Compliance from the MDAQMD, as well as demonstrate continued compliance with regulatory limits when the new equipment becomes operational. The preconstruction review includes demonstrating that the new boilers will use best available control technology (BACT) and will provide any necessary emission offsets.

5.1.2.3.1 Mojave Desert Air Quality Plans

Authority: H&SC §40914

Requirements: Air quality plans define the proposed strategies, including stationary source and transportation control measures and new source review rules that will be implemented to attain and maintain the state ambient air quality standards. The relevant stationary source control measures and new source review requirements are discussed with MDAQMD Rules and Regulations.

Administering Agency: MDAQMD with EPA Region 9 and CARB oversight.

5.1.2.3.2 Mojave Desert Air Quality Management District Rules and Regulations

Authority: H&SC §4000 et seq., H&SC §40200 et seq., indicated MDAQMD Rules

Requirements: Establishes procedures and standards for issuing permits; establishes standards and limitations on a source-specific basis.

Administering Agency: MDAQMD with EPA Region 9 and CARB oversight.

5.1.2.3.3 Authority to Construct

Regulation II—Permits, Rule 201 (Permit to Construct) specifies that any facility installing nonexempt equipment that causes or controls the emission of air pollutants must first obtain an Authority to Construct from the MDAQMD. Under Regulation XIII Rule 1306 (Electric Energy Generating Facilities) Section (E)(3)(b), the District's Final Determination of Compliance acts as an authority to construct for a power plant upon approval of the project by the CEC.

5.1.2.3.4 Review of New or Modified Sources

Regulation XIII (New Source Review) implements the federal NSR and PSD programs, as well as the new source review requirements of the California Clean Air Act. The rule contains the following elements:

- BACT and Lowest Achievable Emission Rates (LAER)
- Emission offsets
- Air quality impact analysis (AQIA)

5.1.2.3.5 Best Available Control Technology

BACT must be applied to any new or modified source which has a potential to emit 25 pounds per day or more of any Nonattainment Air Pollutant. The Nonattainment Air Pollutants are ozone and its precursors NO_x and volatile organic compounds (VOC), and particulate matter (PM_{10}) and its precursors NO_x, SO_x, and VOC.

The MDAQMD defines BACT (Rule 1301(K)(2)) for a non-major facility as the most stringent emission limitation or control technique that:

- Has been achieved in practice for the category or class of source; or
- Is any emission limitation or control technique determined to be technologically feasible and cost-effective; or
- Is contained in any SIP approved by EPA for such emission unit category, unless demonstrated to not be proven in field application, not be technologically feasible, or not be cost-effective.

As shown in Section 5.1.6, none of the sources have a potential to emit above the BACT thresholds. Therefore, none of the sources is subject to the MDAQMD BACT requirements.

5.1.2.3.6 Emission Offsets

A new or modified source resulting in emission increases above the thresholds shown in Table 5.1-1 must offset emission increases of nonattainment pollutants (and their precursors). Table 5.1-1 shows that the emission increases from the Ivanpah SEGS are all below offset thresholds. Therefore, no offsets are required under District regulations.

TABLE 5.1-1
MDAQMD Offset Emission Thresholds

Pollutant	Offset Threshold* (tpy)	Ivanpah Annual Emissions	Offsets Required?
CO	100	4.5	No
Hydrogen Sulfide	10	0	No
Lead	0.6	0	No
PM_{10}	15	1.8	No
NO_x	25	3.4	No
SO_x	25	0.7	No
VOC	25	0.1	No

* MDAQMD Regulation XIII, Rule 1303 (B)(1)

5.1.2.3.7 Toxic Risk Management

Regulation XIII, Rule 1320 (New Source Review for Toxic Air Contaminants) provides a mechanism for evaluating the potential impact of toxic air contaminant (TAC, also called non-criteria pollutants) air emissions from new, modified, and relocated sources in the MDAQMD. The rule imposes more stringent requirements on sources with higher risks, as shown in Table 5.1-2.

TABLE 5.1-2
MDAQMD Health Risk Thresholds

Requirement	Risk Threshold	
	Cancer	Non Cancer
Utilize Toxics BACT	1×10^{-6}	—
Public Notification	10×10^{-6}	1.0
Application Denial	100×10^{-6}	10.0

5.1.2.3.8 CEC Review

Regulation XIII, Rule 1306 establishes a procedure for coordinating MDAQMD review of power plant projects with the CEC's AFC, and Small Power Plant Exemption (SPPE) processes. Under this rule, the MDAQMD reviews the AFC/SPPE and issues a Determination of Compliance for a proposed project. Upon approval of the project by the CEC, this Determination of Compliance is equivalent to an Authority to Construct. A Permit to Operate is issued following demonstration of compliance with all permit conditions.

5.1.2.3.9 Prevention of Significant Deterioration

MDAQMD does not have a rule that implements the federal PSD program.[2] The PSD requirements apply, on a pollutant-specific basis, to any project that is a new major

[2] Currently, the PSD program in the MDAQMD is implemented by EPA Region 9.

stationary source or a major modification to an existing major stationary source. A major source is a listed facility (one of 28 PSD source categories listed in Rule 20.1, NSR General Provisions) that emits at least 100 tpy, or any other facility that emits at least 250 tpy. The PSD requirements also apply to any project expected to have a significant impact upon Class I or Class II areas or significant emissions of non-criteria pollutants. PSD includes the following elements:

- Air quality monitoring
- BACT
- Air quality impact analysis
- Protection of Class I areas
- Growth, visibility, soils, and vegetation impacts

The project will not result in emissions exceeding the applicable PSD thresholds. Ivanpah SEGS will not be "major facility", as defined in the PSD regulations. Therefore, PSD will not apply to this project.

5.1.2.3.10 Acid Rain Permit

Regulation XII Rule 1210 (Acid Rain Provisions of Federal Operating Permits) adopts, by reference, the federal requirements of 40 CFR Part 72, which requires that certain subject facilities comply with maximum operating emissions levels for SO_2 and NO_x, and monitor SO_2, NO_x, and carbon dioxide emissions and exhaust gas flow rates. A Phase II Acid Rain facility, such as a new power plant project, must obtain an Acid Rain permit. A permit application must be submitted to the MDAQMD at least 24 months before operation of the new unit commences. The application must present all relevant Phase II sources at the facility, a compliance plan for each unit, applicable standards, and an estimated commencement date of operations.

5.1.2.3.11 Federal Operating Permit

Regulation XII (Federal Operating Permits) requires new or modified major facilities, NSPS sources, NESHAP sources, and/or Phase II Acid Rain facilities to obtain an operating permit containing the federally enforceable requirements mandated by Title V of the 1990 Clean Air Act Amendments. A permit application for a new or modified source must be submitted to the MDAQMD within 12 months of commencing operation. The application must present a process description, all new stationary sources at the facility, applicable regulations, estimated emissions, associated operating conditions, alternative operating scenarios, a facility compliance plan, and a compliance certification.

5.1.2.3.12 New Source Performance Standards

Regulation IX Rule 900 (Standards of Performance for New Stationary Sources) adopts, by reference, the federal standards of performance for new or modified stationary sources.

The NSPS for Electric Utility Steam Generation Units (40 CFR 60, Subpart Da) applies to new large boilers (>250 MMBtu/hr capacity) that make steam used to generate electricity. The standard is applicable to Ivanpah 3 (416.7 MMBtu/hr). The standard is not applicable to Ivanpah 1 and 2 (231.1 MMBtu/hr each). The NSPS includes standards for particulate matter, sulfur dioxide, nitrogen oxides, and mercury. The PM, SO_2, and mercury standards are all easily met when the only fuel combusted is natural gas, as is the case with the

Ivanpah facility. The Ivanpah boilers are designed to have NO_x emissions of less than 9 ppm (0.012 lb/MMBtu), which complies with the NSPS NO_x standard of 0.2 lb/MMBtu.

5.1.2.3.13 MDAQMD Prohibitory Rules

The general prohibitory rules in Regulation IV applicable to the project include the following:

Rule 401—Visible Emissions

Prohibits visible emissions as dark as, or darker than, Ringelmann No. 1 for periods greater than three minutes in any hour. The use of natural gas in the boilers would eliminate the possibility of a dark visible emission. The proposed emergency engines will meet EPA Tier 2 standards, and will burn clean California diesel fuel. With proper operation, they should not have any difficulty meeting visible emission standards.

Rule 402—Nuisance

Prohibits the discharge from a facility of air pollutants that cause injury, detriment, nuisance, or annoyance to the public, or that damage business or property. The Ivanpah facility will not emit odorous pollutants, and the screening health risk assessment demonstrated that the potential health risks from project emissions are less than significant.

Rule 403—Fugitive Dust

Prohibits visible dust emissions off property due to transport, handling, construction, or storage activity. Requires dust minimization during grading and clearing of land. Limits the difference between upwind and downwind PM concentrations of 100 μg/cubic meter (5-hour average). Requires removal of particulate matter from equipment prior to movement on paved streets. Construction emission mitigation measures will ensure compliance with this requirement.

Rule 403.2—Fugitive Dust Control for the Mojave Desert Planning Area

The project lies outside the Mojave Desert Planning Area.

Rule 404—Combustion Contaminants

Prohibits PM emissions in excess of 0.10 grains per dry standard cubic foot (gr/dscf) from combustion devices. The proposed PM_{10} emission rate for the boilers will limit PM emissions to less than 0.006 gr/dscf. The proposed PM_{10} emission rate for the engines will limit PM emissions to less than 0.05 gr/dscf.

Rule 406—Specific Contaminants

Prohibits sulfur emissions, calculated as SO_2, in excess of 0.05 percent by volume (500 parts per million by volume [ppmv]), and acid gas emissions above specified levels.
SO_2 emissions from the project will be below 0.5 ppmv, based on the fuel sulfur content limit of 0.75 gr/100 scf.

Rule 407—Liquid and Gaseous Air Contaminants

Prohibits carbon monoxide emissions in excess of 2,000 ppmv. CO emissions from the project boilers and engines will be well below 2,000 ppmv.

Rule 431—Sulfur Content of Fuels

Prohibits the burning of gaseous fuel with a sulfur content of more than 800 ppm and liquid fuel with a sulfur content of more than 0.5 percent sulfur by weight. Project natural gas fuel and CARB ultra-low sulfur diesel fuel will easily meet these requirements.

Rule 475—Electric Power Generating Equipment

Limits NO_x and PM emissions from electrical generating equipment rated greater than or equal to 50 MMBtu/hr to RACT levels. This rule applies to the emergency engines (NO_x limit = 160 ppmv, firing on liquid fuel; PM limit not to exceed 0.01 gr/dscf @ 3 percent O_2 and 5 kg/hour). The proposed Tier 2 emergency diesel engines will meet this requirement.

Rule 476—Steam Generating Equipment

Limits NO_x emissions from steam generators rated above 50 MMBtu/hr to 125 ppm. This rule applies to the boilers. The boilers will be designed to meet a NO_x level of 9 ppm.

The following source-specific rules in Regulation XI are not applicable to the project because they apply only to sources located within the Federal Ozone Nonattainment Area:

Rule 1157 – Boilers and Process Heaters

Limits CO and NO_x from boilers. Applies only to boilers located within the Federal Ozone Nonattainment Area, and therefore does not apply to Ivanpah.

Rule 1160—Internal Combustion Engines

Limits emissions from internal combustion engines. Applies only to engines located within the Federal Ozone Nonattainment Area, and therefore does not apply to Ivanpah.

All applicable LORS are summarized in Table 5.1-3 along with identification of the section that discusses compliance with each requirement.

5.1.3 Air Quality Setting

The geography of the potential site, elevations of the surrounding landscape, long-term climatic characteristics, and short-term weather variations all have important effects on the ground-level pollutant concentrations that result from project air emissions. The effects of the land and atmospheric variables are discussed separately.

5.1.3.1 Geography and Topography

The project site is in the Ivanpah Valley approximately 4.5 miles southwest of the intersection of Interstate 15 and the Nevada border at Stateline, Nevada, and 5.5 miles southwest of Primm, Nevada. The nominal site elevations for the Ivanpah 1, 2, and 3 plant sites are 878, 922, and 924 meters above mean sea level (amsl), respectively. Although the general area in the immediate vicinity of the project site is relatively flat, a knob of volcanic rock rises to 3,160 feet amsl 0.8 mile directly east of the sites, and complex terrain rises up to 6,000 feet amsl within 4 to 8 miles in most directions (except to the southeast).

TABLE 5.1-3
Laws, Ordinances, Regulations, Standards and Permits for Protection of Air Quality

LORS	Purpose	Regulating Agency	Permit or Approval	Schedule and Status of Permit	Conformance (Sections)
Federal					
Clean Air Act (CAA) §160-169A and implementing regulations, Title 42 United States Code (USC) §7470-7491 (42 USC §7470-7491), Title 40 Code of Federal Regulations (CFR) Parts 51 & 52 (Prevention of Significant Deterioration Program)	Requires prevention of significant deterioration (PSD) review and facility permitting for construction of new or modified major stationary sources of air pollution. PSD review applies to pollutants for which ambient concentrations are lower than NAAQS.	EPA	PSD Permit for a New Major Source or major modification.	Not applicable	5.1.2.1
CAA §171-193, 42 USC §7501 et seq. (New Source Review)	Requires new source review (NSR) facility permitting for construction or modification of specified stationary sources. NSR applies to pollutants for which ambient concentration levels are higher than NAAQS.	MDAQMD with EPA oversight	Determination of Compliance (DOC) with conditions limiting emissions.	Not applicable.	5.1.2.1
CAA §401 (Title IV), 42 USC §7651 (Acid Rain Program)	Requires reductions in NO_x and SO_2 emissions.	MDAQMD with EPA oversight	Acid Rain program requirements included in Determination of Compliance, Permit to Operate, and Title V permit.	Meet compliance deadlines listed in regulations.	5.1.2.1
CAA §501 (Title V), 42 USC §7661 (Federal Operating Permits Program)	Establishes comprehensive permit program for major stationary sources.	MDAQMD with EPA oversight	Title V permit after review of application.	Permit application to be submitted within 12 months after commencement of operation.	5.1.2.1
CAA §111, 42 USC §7411, 40 CFR Part 60 (New Source Performance Standards – NSPS)	Establishes national standards of performance for new stationary sources.	MDAQMD with EPA oversight	DOC with conditions limiting emissions.	Not applicable	5.1.2.1

TABLE 5.1-3
Laws, Ordinances, Regulations, Standards and Permits for Protection of Air Quality

LORS	Purpose	Regulating Agency	Permit or Approval	Schedule and Status of Permit	Conformance (Sections)
State					
H&SC §44300-44384; California Code of Regulations (CCR) §93300-93347 (Toxic "Hot Spots" Act)	Requires preparation and biennial updating of facility emission inventory of hazardous substances; risk assessments.	MDAQMD with CARB oversight	DOC with conditions limiting emissions.	Screening HRA submitted as part of AFC.	5.1.2.2
California Public Resources Code §25523(a); 20 CCR §§1752, 2300-2309 (CEC & CARB Memorandum of Understanding)	Requires that CEC's decision on AFC include requirements to assure protection of environmental quality; AFC required to address air quality protection.	CEC	Final Certification with conditions limiting emissions.	MDAQMD issuance of DOC precedes CEC approval of AFC.	5.1.2.2
17 CCR § 93115 (ATCM for Stationary Compression Ignition Engines)	Establishes emission and operational limits for diesel-fueled stationary compression ignition engines.	MDAQMD and CARB	DOC with conditions limiting emissions and operation.	Agency approval to be obtained before start of construction.	5.1.2.2
Local					
MDAQMD Regulation XIII (New Source Review)	NSR: Requires that pre-construction review be conducted for all proposed new or modified sources of air pollution, including BACT, emissions offsets, and air quality impact analysis.	MDAQMD with CARB oversight	DOC with conditions limiting emissions.	Agency approval to be obtained before start of construction.	5.1.2.3
MDAQMD Rule 1320 (New Source Review for Toxic Air Contaminants)	Requires that pre-construction review be conducted for all proposed new or modified sources of toxic air contaminants	MDAQMD with EPA oversight	DOC with conditions limiting emissions.	Agency approval to be obtained before start of construction.	5.1.2.3
MDAQMD Regulation XII (Federal Operating Permits)	Implements operating permits requirements of CAA Title V.	MDAQMD with EPA oversight	Issues Title V permit after review of application.	Application to be made within 12 months of start of facility operation.	5.1.2.3

TABLE 5.1-3
Laws, Ordinances, Regulations, Standards and Permits for Protection of Air Quality

LORS	Purpose	Regulating Agency	Permit or Approval	Schedule and Status of Permit	Conformance (Sections)
MDAQMD Rule 1210 (Acid Rain Provisions of Federal Operating Permits)	Implements Acid Rain regulations of CAA Title IV.	MDAQMD with EPA oversight	Title IV requirements included in DOC, Permit to Operate, and Title V permit.	Application to be made 24 months before start of facility operation.	5.1.2.3
MDAQMD Rule 401 (Visible Emissions)	Limits visible emissions to no darker than Ringelmann No. 1 for periods greater than 3 minutes in any hour.	MDAQMD with CARB oversight	DOC with conditions limiting emissions.	Agency approval to be obtained prior to commencement of operation.	5.1.2.3
MDAQMD Rule 402 (Nuisance)	Prohibits emissions in quantities that adversely affect public health, other businesses, or property.	MDAQMD with CARB oversight	DOC with conditions limiting emissions.	Agency approval to be obtained before start of construction.	5.1.2.3
MDAQMD Rule 403 (Fugitive Dust)	Limits PM emissions from construction activity.	MDAQMD with CARB oversight	DOC with conditions limiting emissions.	Agency approval to be obtained before start of construction.	5.1.2.3
MDAQMD Rule 404 (Combustion Contaminants)	Limits PM emissions from combustion sources.	MDAQMD with CARB oversight	DOC with conditions limiting emissions.	Agency approval to be obtained before start of construction.	5.1.2.3
MDAQMD Rule 406 (Specific Contaminants)	Limits SO_2 emissions from stationary sources.	MDAQMD with CARB oversight	DOC with conditions limiting emissions.	Agency approval to be obtained before start of construction.	5.1.2.3
MDAQMD Rule 407 (Liquid and Gaseous Air Contaminants)	Limits CO emissions from combustion sources.	MDAQMD with CARB oversight	DOC with conditions limiting emissions.	Agency approval to be obtained before start of construction.	5.1.2.3
MDAQMD Rule 431 (Sulfur Content of Fuels)	Limits the sulfur content of fuels combusted in stationary sources.	MDAQMD with CARB oversight	DOC with conditions limiting emissions.	Agency approval to be obtained before start of construction.	5.1.2.3

TABLE 5.1-3
Laws, Ordinances, Regulations, Standards and Permits for Protection of Air Quality

LORS	Purpose	Regulating Agency	Permit or Approval	Schedule and Status of Permit	Conformance (Sections)
MDAQMD Rule 475 (Electric Power Generating Equipment)	Limits NO_x and PM emissions from power generating equipment (i.e., emergency engines).	MDAQMD with CARB oversight	DOC with conditions limiting emissions.	Agency approval to be obtained before start of construction.	5.1.2.3
MDAQMD Rule 476 (Steam Generating Equipment)	Limits NO_x emissions from boilers.	MDAQMD with CARB oversight	DOC with conditions limiting emissions.	Agency approval to be obtained before start of construction.	5.1.2.3
MDAQMD Regulation IX (New Source Performance Standards: 40 CFR 60, Subpart Da, Boilers)	Requires monitoring of fuel, other operating parameters; limits NO_x and SO_2 and PM emissions, requires source testing, emissions monitoring, and recordkeeping.	MDAQMD with CARB oversight	DOC with conditions limiting emissions.	Agency approval to be obtained before start of construction.	5.1.2.3
MDAQMD Regulation IX (New Source Performance Standards: 40 CFR 60, Subpart IIII, Stationary Compression Ignition Internal Combustion Engines)	Limits ozone precursors, CO and PM emissions.	MDAQMD with CARB oversight	DOC with conditions limiting emissions.	Agency approval to be obtained before start of construction.	5.1.2.3

5.1.3.2 Climate and Meteorology

The climate in the MDAQMD is desert. The cool, moist coastal air from the South Coast Air Basin is blocked by the San Gabriel and San Bernardino mountain ranges. The area is characterized by hot, dry summers and mild winters with annual rainfall averaging 2 to 5 inches per year. Meteorology tends to be influenced by a moderately intense anticyclonic circulation except during frontal activity (storms) in the winter. During the winter, there are an average to 20-30 frontal systems. In the summer, the MDAQMD is usually influenced by a Pacific Subtropical High cell that sits off the coast of California. The prevailing winds are out of the west and south, resulting in a general west to east flow across the MDAQMD.

The amount of solar radiation is one factor influencing thermal turbulence, and the more thermal turbulence, the more dispersion of pollutants. The project area receives significant sunshine throughout the year, even during winter (over 3,000 hours per year of sunshine).

Hourly surface meteorological data (e.g., hourly wind speed and direction, temperature) for Jean, Nevada during the period 2001-2004 was obtained from the website of the Clark County (Nevada) Department of Air Quality and Environmental Management.[3] The Jean monitoring station is located approximately 16 miles north-northeast of the project site. The data for 2001 and 2002 were used in the air dispersion modeling. To the extent data were missing from the Jean datasets, surface meteorological data were substituted from data measured at Nellis Air Force Base, located approximately 35 miles northeast of the project site. Upper air data were taken from the Desert Rock, Nevada monitoring station located north of Las Vegas, and approximately 70 miles northwest of the project site.

Wind speed and direction are key factors influencing the dispersion and transport of pollutants. Wind flows on an annual basis are predominately westerly. At Jean, Nevada, the most frequent wind direction is from the west-southwest. Wind speeds average approximately 5 miles per hour. Appendix 5.1A contains the eight quarterly plus annual wind roses and eight quarterly plus annual wind frequency tables for the two years, 2001 and 2002, used in the air dispersion modeling. Annual wind roses for 2001 and 2002 are presented in Figures 5.1-1 and 5.1-2. Predominant seasonal wind patterns in California are presented in Figures 5.1-3 through 5.1-6

Temperatures in the project area range from an average of 39°F in December and January to 79°F in July. Relative humidity in the Mojave Desert is typically 10 percent on summer afternoons, and 30 percent on winter afternoons. Precipitation in the vicinity of the project averages approximately 8.5 inches per year, with most of the precipitation in the winter.[4]

5.1.4 Overview of Air Quality Standards

The U.S. Environmental Protection Agency has established national ambient air quality standards (NAAQS) for ozone, nitrogen dioxide (NO_2), carbon monoxide (CO), sulfur dioxide (SO_2), particulate matter with aerodynamic diameter less than or equal to 10 microns (PM_{10}), particulate matter with aerodynamic diameter less than or equal to

[3] Clark County Department of Air Quality and Environmental Management, Archive Retrieval, http://www.ccairquality.org/archives/index.html.

[4] WorldClimate. Average Rainfall for Mountain Pass, California, USA, taken from NCDC Cooperative Stations for 1955-1995, http://www.worldclimate.com/cgi-bin/data.pl?ref=N35W116+2200+040436C, accessed June 27, 2007.

2.5 microns ($PM_{2.5}$), and airborne lead. Areas with ambient levels above these standards are designated by EPA as "nonattainment areas" subject to planning and pollution control requirements that are more stringent than standard requirements.

The California Air Resources Board has established California ambient air quality standards for ozone, CO, NO_2, SO_2, sulfates, PM_{10}, $PM_{2.5}$, airborne lead, hydrogen sulfide, and vinyl chloride at levels designed to protect the most sensitive members of the population, particularly children, the elderly, and people who suffer from lung or heart diseases.

Both state and national air quality standards consist of two parts: an allowable concentration of a pollutant, and an averaging time over which the concentration is to be measured. Allowable concentrations are based on the results of studies of the effects of the pollutants on human health, crops and vegetation, and, in some cases, damage to paint and other materials. The averaging times are based on whether the damage caused by the pollutant is more likely to occur during exposures to a high concentration for a short time (one hour, for instance), or to a relatively lower average concentration over a longer period (8 hours, 24 hours, or 1 month). For some pollutants there is more than one air quality standard, reflecting both short-term and long-term effects. Table 5.1-4 presents the NAAQS and California ambient air quality standards for selected pollutants. The California standards are generally set at concentrations lower than the federal standards and, in some cases, have shorter averaging periods.

EPA's current NAAQS for ozone and fine particulate matter went into effect on September 16, 1997. For ozone, the previous federal 1-hour standard of 0.12 ppm was replaced by an 8-hour average standard at a level of 0.08 ppm. Compliance with this standard is based on the three-year average of the annual 4th-highest daily maximum 8-hour average concentration measured at each monitor within an area. The NAAQS for particulates were revised in several respects. First, the annual standard for PM_{10} was revoked. Additionally, two new $PM_{2.5}$ standards were added: a standard of 15 $\mu g/m^3$, based on the three-year average of annual arithmetic means from single or multiple monitors (as available); and a standard of 35 $\mu g/m^3$, based on the three-year average of the 98th percentile of 24-hour average concentrations at each monitor within an area.

The state adopted a new, lower annual PM_{10} standard of 20 $\mu g/m^3$. The state $PM_{2.5}$ standard is 12 $\mu g/m^3$ on an annual average basis. On April 28, 2005, CARB approved a new 8-hour ozone standard of 0.070 ppm; this new standard became effective on May 17, 2006.

Finally, on February 22, 2007, CARB adopted a new NO_x 1-hour standard, reducing it from 0.25 ppm to 0.18 ppm. This new standard is currently under review, and is not yet effective. This Air Quality Impact Analysis is based on currently effective standards.

TABLE 5.1-4
NAAQS and California Ambient Air Quality Standards for Selected Pollutants

Pollutant	Averaging Time	California	National
Ozone	1-hour	0.09 ppm	—
	8-hour	0.070 ppm	0.08 ppm [a]

TABLE 5.1-4
NAAQS and California Ambient Air Quality Standards for Selected Pollutants

Pollutant	Averaging Time	California	National
Carbon Monoxide	8-hour	9.0 ppm (10 mg/m^3)	9 ppm (10 mg/m^3)
	1-hour	20 ppm (23 mg/m^3)	35 ppm (40 mg/m^3)
Nitrogen Dioxide	Annual Average	[b]	0.053 ppm (100 µg/m^3)
	1-hour	0.25 ppm (470 µg/m^3)[e]	—
Sulfur Dioxide	Annual Average	—	0.03 ppm (80 µg/m^3)
	24-hour	0.04 ppm (105 µg/m^3)	0.14 ppm (365 µg/m^3)
	3-hour	—	0.5 ppm (1,300 µg/m^3) [c]
	1-hour	0.25 ppm (655 µg/m^3)	—
Respirable Particulate Matter (10 Micron)	Annual Arithmetic Mean	20 µg/m^3	
	24-hour	50 µg/m^3	150 µg/m^3 [d]
Fine Particulate Matter (2.5 Micron)	Annual Arithmetic Mean	12 µg/m^3	15 µg/m^3 (3-year average)
	24-hour	—	35 µg/m^3 [e]
Sulfates	24-hour	25 µg/m^3	—
Lead	30 days	1.5 µg/m^3	—
	Calendar Quarter	—	1.5 µg/m^3
Hydrogen Sulfide	1-hour	0.03 ppm	—
Vinyl Chloride	24-hour	0.010 ppm	—
Visibility Reducing Particles	8-hour (10 am to 6 pm PST)	[f]	—

[a] 3-year average of annual 4th-highest daily maximum.

[b] State has adopted a new 1-hour NO_x standard of 0.18 ppm (338 µg/m^3) and an annual NO_x standard of 0.030 ppm (56 µg/m^3) that are awaiting OAL approval before implementation.

[c] This is a national secondary standard, which is designed to protect public welfare.

[d] No more than two exceedances at any site in a three year period.

[e] 3-year average of 98th percentiles.

[f] In sufficient amount to produce an extinction coefficient of 0.23 per kilometer due to particles when the relative humidity is less than 70 percent.

5.1.5 Existing Air Quality

In coordination with the AQMD, data from several representative ambient air monitoring stations were used to characterize air quality at the Ivanpah SEGS site. All ambient air quality data presented in this section were taken from CARB publications and data sources or EPA air quality data tables. Ambient concentrations of ozone, NO_2, and PM_{10} are recorded at two monitoring stations: one located in Barstow, about 100 miles west-southwest of the project site; and the other located in Trona, 110 miles west-northwest of the project site. CO is also measured at Barstow. SO_2 is also measured in Trona.

The nearest California $PM_{2.5}$ monitor is in Big Bear City, 120 miles southwest of the Ivanpah SEGS site.

The nearest lead monitor is located in San Bernardino, 140 miles southwest of the Ivanpah SEGS site.

The nearest sulfate monitor is located in Riverside, Riverside County. Sulfate measurements at most monitoring stations in California were discontinued years ago, and are no longer reported on the CARB website, because sulfur dioxide emissions are low enough to prevent sulfate levels from being anywhere near the California ambient air quality standard of 25 $\mu g/m^3$ on a 24-hour average basis.

Ambient PM_{10} concentrations are monitored at four locations in Pahrump, Nevada, 50 miles from the Ivanpah SEGS site. The Pahrump Valley is experiencing local elevated PM levels due to intense development in Pahrump Valley.[5] The level of development that is causing problems in Pahrump is not present at the Ivanpah site. Therefore the data from the Pahrump stations are not useful as background data for the Ivanpah SEGS.

5.1.5.1 Ozone

Ozone is generated by a complex series of chemical reactions between VOC and NO_x in the presence of ultraviolet radiation. Ambient ozone concentrations follow a seasonal pattern: higher in the summertime and lower in the wintertime. At certain times, the general area can provide ideal conditions for the formation of ozone due to the persistent temperature inversions, clear skies, mountain ranges that trap the air mass, and exhaust emissions from millions of vehicles and stationary sources. The entire MDAQMD has been designated nonattainment of the ozone CAAQS. CARB has classified the MDAQMD as a moderate ozone nonattainment area based on a 110 ppb ozone design value monitored at Barstow, California on April 29, 1989.

The eastern portion of San Bernardino County (including the project site) has been designated by EPA as “unclassified/attainment” for the federal 1-hour and 8-hour ozone standards.

Table 5.1-5 shows the annual maximum hourly ozone levels recorded at the Barstow and Trona stations during the period 1997-2006, as well as the number of days in which the state and federal standards were exceeded.

TABLE 5.1-5
Ozone Levels in San Bernardino County, Barstow and Trona Monitoring Stations, 1997-2006 (ppm)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Barstow Monitoring Station										
Highest 1-Hour Average	0.114	0.108	0.123	0.114	0.109	0.108	0.105	0.100	0.099	0.112
Highest 8-hour Average	0.106	0.090	0.107	0.088	0.099	0.096	0.095	0.083	0.092	0.094

5 See http://ndep.nv.gov/baqp/pahrump.html

TABLE 5.1-5
Ozone Levels in San Bernardino County, Barstow and Trona Monitoring Stations, 1997-2006 (ppm)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
3-year Average of 4th-Highest 8-Hour Average	0.087	0.088	0.090	0.088	0.088	0.087	0.088	0.087	0.085	0.084
Number of Days Exceeding:										
State Standard* (0.09 ppm, 1-hour)	15	9	10	9	5	12	8	2	3	4
Federal Standard (0.08 ppm, 8-hour)	11	5	10	6	5	13	11	0	4	6
Trona Monitoring Station										
Highest 1-Hour Average	0.098	0.109	0.099	0.091	0.086	0.107	0.098	0.111	0.091	0.091
Highest 8-hour Average	—	0.102	0.088	0.083	0.076	0.095	0.091	0.084	0.085	0.084
3-year Average of 4th-Highest 8-Hour Average	—	—	—	0.082	0.078	0.080	0.083	0.086	0.083	0.080
Number of Days Exceeding:										
State Standard* (0.09 ppm, 1-hour)	1	4	1	0	0	5	3	1	0	0
Federal Standard (0.08 ppm, 8-hour)	0	4	2	0	0	7	5	0	1	0

Source: California Air Quality Data, California Air Resources Board website (http://www.arb.ca.gov/adam/welcome.html).

* Measured values are rounded to the same number of significant figures before comparison with this standard; consequently, a value of 0.093 is rounded to 0.09, which does not exceed the standard. Trends related to the new state 8-hour average ozone standard of 0.070 ppm are not yet available.

The long-term trends of maximum 1-hour ozone readings and violations of the state and federal standard are shown in Figure 5.1-7 for both monitoring stations. Trends of maximum and three-year average of the 4th-highest daily concentrations of 8-hour average ozone readings and exceedances of the federal standard are shown in Figure 5.1-8.

5.1.5.2 Nitrogen Dioxide

Atmospheric NO_2 is formed primarily from reactions between nitric oxide (NO) and oxygen or ozone. NO is formed during high temperature combustion processes, when the nitrogen and oxygen in the combustion air combine. Although NO is less harmful than NO_2, it can be converted to NO_2 in the atmosphere within minutes to hours, depending on the composition and temperature of the atmosphere. For purposes of state and federal air quality planning, the MDAQMD is in attainment for NO_2.

Table 5.1-6 shows the long-term trend of maximum 1-hour NO_2 levels recorded at the Barstow and Trona monitoring stations for 1997-2006, as well as the annual average level for each of those years. During this period, there has not been a single violation of either the state 1-hour standard or the federal annual average NO_2 standard.

TABLE 5.1-6
Nitrogen Dioxide Levels in San Bernardino County, Barstow and Trona Monitoring Stations, 1997-2006 (ppm)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Barstow Monitoring Station										
Highest 1-Hour Average	0.107	0.196	0.106	0.105	0.102	0.091	0.095	0.101	0.087	0.082
Annual Average (NAAQS = 0.053 ppm)	0.020	0.022	0.024	0.025	0.024	0.025	0.024	0.023	0.022	0.022
Trona Monitoring Station										
Highest 1-Hour Average	0.066	0.062	0.053	0.052	0.055	0.051	0.052	0.055	0.053	0.050
Annual Average (NAAQS = 0.053 ppm)	-	0.006	0.006	0.006	0.006	0.005	0.005	0.005	0.005	0.005

Source: California Air Quality Data, California Air Resources Board website (http://www.arb.ca.gov/adam/welcome.html).

Figure 5.1-9 shows the historical trend of maximum 1-hour NO_2 levels at the Barstow and Trona monitoring stations. Annual average concentrations and trends are shown in Figure 5.1-10.

5.1.5.3 Carbon Monoxide

CO is a product of inefficient combustion, principally from automobiles and other mobile sources of pollution. In many areas of California, CO emissions from wood-burning stoves and fireplaces can also be measurable contributors to ambient CO levels. Industrial sources typically contribute less than 10 percent of ambient CO levels. Peak CO levels usually occur during winter due to a combination of higher emission rates and calm weather conditions with strong, ground-based inversions. The MDAQMD is classified as an attainment area for CO with respect to both state and national standards.

Table 5.1-7 shows the maximum one- and 8-hour average levels for CO, recorded at the Barstow monitoring station during the period 1997-2006 (CO data were not reported for Trona).

TABLE 5.1-7
Carbon Monoxide Levels in San Bernardino County, Barstow Monitoring Station, 1997-2006 (ppm)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Highest 1-hour average	3.9	3.9	4.2	2.1	2.3	1.9	2.7	1.6	3.3	3.5
Highest 8-hour average	1.64	2.21	1.38	1.48	1.20	1.10	1.51	1.18	1.34	1.19

Source: California Air Quality Data, California Air Resources Board website (http://www.arb.ca.gov/adam/welcome.html); EPA AIRData website (http://www.epa.gov/air/data/index.html).

Trends of maximum one- and 8-hour average CO concentrations are shown in Figures 5.1-11 and 5.1-12, which show that maximum ambient CO levels in Barstow have been well below the state and federal standards for the last 10 years.

5.1.5.4 Sulfur Dioxide

SO_2 is produced when any sulfur-containing fuel is burned. It is also emitted by chemical plants that treat, or refine, sulfur or sulfur-containing chemicals. Natural gas contains only a small amount of sulfur, typically about 0.2 grains per standard cubic foot, while fuel oils contain larger amounts, typically in the range of 15 ppm (for ultra-low sulfur diesel fuel) to 4 percent (for marine bunker fuels). Peak, but low, concentrations of SO_2 occur at different times of the year in different parts of California, depending on local fuel characteristics, weather, and topography. The MDAQMD is considered to be in attainment for SO_2 for purposes of state and federal air quality planning.

Table 5.1-8 presents the state air quality standard for SO_2 and the maximum levels recorded from 1997 through 2006 at the Trona monitoring station. SO_2 data were not reported on the CARB site for Barstow. The federal 24-hour average standard is 0.14 ppm; during the period shown, the average SO_2 levels measured at stations in the project area have been less than 10 percent of the federal standard. Figure 5.1-13 shows that for several years the maximum 24-hour SO_2 levels typically have been less than approximately one-tenth of the state standard.

TABLE 5.1-8
Sulfur Dioxide Levels in San Bernardino County, Trona Monitoring Station, 1997-2006 (ppm)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Highest 1-Hour Average	0.035	0.013	0.014	0.012	0.012	0.012	0.008	0.019	0.018	0.033
Highest 3-Hour Average	0.008	0.010	0.012	0.008	0.010	0.009	0.005	0.010	0.011	0.017
Highest 24-Hour Average	.005	.010	.006	.006	.007	.007	.003	.005	.004	.004
Annual Average	.001	.001	.002	.001	.001	.001	.001	.001	.001	.001

Source: California Air Quality Data, California Air Resources Board website (http://www.arb.ca.gov/adam/welcome.html); EPA AIRData website (http://www.epa.gov/air/data/index.html).

5.1.5.5 Respirable Particulate Matter (PM_{10})

Particulates in the air are caused by a combination of wind-blown fugitive dust; particles emitted from combustion sources and manufacturing processes; sea salts; and organic, sulfate, and nitrate aerosols formed in the air from emitted hydrocarbons, sulfur oxides, and nitrogen oxides, respectively. In 1984, CARB adopted standards for PM_{10} and phased out the total suspended particulate (TSP) standards that had been in effect previously. PM_{10} standards were substituted for TSP standards because PM_{10} corresponds to the size range of particulates that can be inhaled into the lungs (respired), and therefore is a better measure to use in assessing potential health effects. In 1987, EPA also replaced national TSP standards with PM_{10} standards. San Bernardino County is nonattainment for the federal PM_{10} standard, and MDAQMD is a nonattainment area for the state standard.

Table 5.1-9 shows the federal and state air quality standards for PM_{10}, maximum levels recorded at the Barstow and Trona monitoring stations during 1997-2006, and geometric and arithmetic annual averages for the same period. The maximum 24-hour and the annual average PM_{10} levels exceed the state standards, but the annual average PM_{10} levels have remained below the federal standards throughout the period.

The trend of maximum 24-hour average PM_{10} levels is plotted in Figure 5.1-14, and the trend of expected violations of the state 24-hour standard (50 µg/m^3) is plotted in Figure 5.1-15. Note that since PM_{10} is measured only once every six days, expected violation days are six times the number of measured violations. The trend of maximum annual average PM_{10} readings and the California and federal standards are shown in Figure 5.1-16.

TABLE 5.1-9
PM_{10} Levels in San Bernardino County, Barstow and Trona Monitoring Stations, 1997-2006 (µg/m^3)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Barstow Monitoring Station										
Highest 24-Hour Average	58.0	53.0	69.0	69.0	51.0	57.0	143.0	40.0	78.0	80.0
Annual Arithmetic Mean	25.0	23.4	25.7	27.7	26.4	32.5	25.7	21.3	25.4	21.9
Number of Days Exceeding:										
State Standard (50 µg/m^3, 24 hour)	*	*	*	*	*	*	*	*	19.1	*
Federal Standard (150 µg/m^3, 24 hour)	0	0	0	0	0	0	*	0	0	*
Trona Monitoring Station										
Highest 24-Hour Average	85.0	88.8	106.8	95.6	97.9	522.0	186.8	139.6	130.8	184.4
Annual Arithmetic Mean	12.1	9.3	11.1	9.9	9.8	14.0	11.0	10.8	11.2	11.2
Number of Days Exceeding:										
State Standard (50 µg/m^3, 24-hour)	*	*	*	6.1	*	*	6.6	*	0	11.9
Federal Standard (150 µg/m^3, 24-hour)	*	0	0	*	0	2.9	1.2	0	0	2.0

Source: California Air Quality Data, California Air Resources Board website (http://www.arb.ca.gov/adam/welcome.html); EPA AIRData website (http://www.epa.gov/air/data/index.html).

* There was insufficient (or no) data available to determine the number

5.1.5.6 Fine Particulate Matter ($PM_{2.5}$)

As discussed previously, the NAAQS for particulates were further revised by EPA with new standards that went into effect on September 16, 1997; two new $PM_{2.5}$ standards were added at that time. In June 2002, CARB established a new annual standard for $PM_{2.5}$. $PM_{2.5}$ data have been collected at the Big Bear City monitoring station since 1999, and are presented below.

Table 5.1-10 shows the state and federal air quality standards for $PM_{2.5}$, maximum levels recorded at the Big Bear City monitoring station 1999-2006, and three-year averages for the same period. The 24-hour average concentrations have not exceeded the federal standard throughout the monitoring period; however, there are not enough data available to draw conclusions regarding trends in the three-year average of 98th percentile values. Annual average $PM_{2.5}$ levels have been below both the federal standard and the state standard. Eastern San Bernardino County, where the Ivanpah SEGS is located, is unclassified for the state $PM_{2.5}$ standard, and is unclassified/attainment for the federal standard.

The trends of 24-hour and annual average $PM_{2.5}$ levels are plotted in Figures 5.1-17 and 5.1-18, respectively.

TABLE 5.1-10
$PM_{2.5}$ Levels in San Bernardino County, Big Bear City Monitoring Station, 1997-2006 (μg/m³)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Highest 24-hour Average	—	—	32.1	29.0	34.6	34.1	35.0	28.6	38.7	40.0
98th Percentile	—	—	30.5	—	30.2	—	28.8	—	—	—
3-year Average, 98th Percentile	—	—	—	—	—	—	—	—	—	—
Annual Arithmetic Mean	—	—	10.3	—	11.2	—	10.6	—	—	—
3-year Annual Average	—	—	—	—	—	—	—	—	—	—

Source: California Air Quality Data, California Air Resources Board website (http://www.arb.ca.gov/adam/welcome.html); EPA AIRData website (http://www.epa.gov/air/data/index.html).

5.1.5.7 Airborne Lead

The majority of lead in the air results from the combustion of fuels that contain lead. Twenty-five years ago, motor gasoline contained relatively large amounts of lead compounds used as octane-rating improvers, and ambient lead levels were relatively high. Beginning with the 1975 model year, new automobiles began to be equipped with exhaust catalysts, which were poisoned by the exhaust products of leaded gasoline. Thus, unleaded gasoline became the required fuel for an increasing fraction of new vehicles, and the phase-out of leaded gasoline began. As a result, ambient lead levels decreased dramatically. San Bernardino County has been in attainment of state and federal airborne lead levels for air quality planning purposes for a number of years.

Ambient lead levels are monitored in San Bernardino. Table 5.1-11 lists the federal air quality standard for airborne lead and the levels reported in San Bernardino between 1997 and 2006. Maximum quarterly levels are not reported on EPA's website; because the maximum 24-hour averages must be higher than the quarterly average, the data show that lead levels are actually well below the federal standard.[6]

TABLE 5.1-11
Airborne Lead Levels in San Bernardino County, San Bernardino Monitoring Station, 1997-2006 (μg/m³)

	1997	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Highest 24-hour Average	0.09	0.09	0.18	0.12	0.07	0.04	0.35	0.03	0.03	0.03
Number of Days Exceeding:										
Federal Standard (1.5 μg/m³, quarterly)	0	0	0	0	0	0	0	0	0	0

Source: EPA AirData website (http://www.epa.gov/air/data/index.html).

6 ARB no longer reports summary lead statistics on its website.

5.1.5.8 Attainment Status

Based on the measured existing air quality described in Section 5.1.5, the ambient air quality standards presented in Table 5.1-4, and the responsibilities of the EPA and the CARB discussed in Sections 5.1.2.1 and 5.1.2.2, respectively, the resulting attainment status of the Mojave Desert Air Basin is shown in Table 5.1-12.

TABLE 5.1-12
Ambient Air Quality Standard Attainment Status in Mojave Desert Air Basin

Pollutant	Averaging Time	California	National
Ozone	1-hour	Nonattainment	No NAAQS
	8-hour	Nonattainment	Attainment
Carbon Monoxide	8-hour	Attainment	Attainment
	1 hour	Attainment	Attainment
Nitrogen Dioxide	Annual Average	No CAAQS	Attainment
	1-hour	Attainment	No NAAQS
Sulfur Dioxide	Annual Average	No CAAQS	Attainment
	24-hour	Attainment	Attainment
	3-hour	No CAAQS	Attainment
	1-hour	Attainment	No NAAQS
Respirable Particulate Matter (10 Micron)	Annual Arithmetic Mean	Nonattainment	No NAAQS
	24-hour	Nonattainment	Nonattainment
Fine Particulate Matter (2.5 Micron)	Annual Arithmetic Mean	Unclassified	Attainment
	24-hour	No CAAQS	Attainment
Sulfates	24-hour	Attainment	No NAAQS
Lead	30 days	Attainment	No NAAQS
	Calendar Quarter	No CAAQS	Attainment
Hydrogen Sulfide	1-hour	Unclassified	No NAAQS
Vinyl Chloride	24-hour	Unclassified	No NAAQS
Visibility Reducing Particles	8-hour (10 am to 6 pm PST)	Unclassified	No NAAQS

5.1.6 Environmental Analysis

Ambient air quality impact analyses for the Ivanpah SEGS have been conducted to satisfy the MDAQMD, EPA, and CEC requirements for analysis of impacts from criteria pollutants (NO_2, CO, PM_{10}, and SO_2) and noncriteria pollutants during project construction and operation. The analyses cover each phase of the project. Section 5.1.6.1 gives an overview of the analytical approach. Section 5.1.6.2 presents the emissions for operation of each facility, and Section 5.1.6.3 gives the ambient air quality impacts of operation. Section 5.1.6.4 gives the analysis for construction of the each facility.

5.1.6.1 Overview of the Analytical Approach to Estimating Facility Impacts

The following sections describe the emission sources that have been evaluated, the results of the ambient impact analyses, and the evaluation of the Ivanpah SEGS compliance with the applicable air quality regulations, including the MDAQMD's NSR requirements. These analyses are designed to confirm that the project's design features lead to less-than–significant impacts even with the following conservative analysis assumptions and procedures: maximum allowable emission rates, project operating schedules that lead to maximum emissions, worst-case meteorological conditions, and adding the worst-observed existing air quality to the highest potential ground-level impact from modeling, even when all of these situations could not physically occur at the same time.

5.1.6.1.1 Emitting Units

The project is composed of three plants: Ivanpah 1 (100 MW), Ivanpah 2 (100 MW) and Ivanpah 3 (200 MW). Ivanpah 1 and 2 are identical plants, and Ivanpah 3 is a scaled up version of the others. The phasing is planned so that Ivanpah 1 (the southernmost site) will be constructed first, followed by Ivanpah 2 (the middle site), then Ivanpah 3 (the 200-MW plant on the north), though the order of construction may change.

Each plant has a 24-month construction schedule. This analysis is based on the assumption that the last 12 months of construction of Ivanpah 1 will overlap with the first 12 months of construction of Ivanpah 2, and that the last 12 months of construction of Ivanpah 2 will overlap with the first twelve months of construction of Ivanpah 3.

Each plant will have three emitting units: a natural gas-fired boiler, a diesel fuel fired emergency engine, and a diesel fuel fired fire pump.

Each boiler will be equipped with low-NO_x burners for NO_x control. CO will be controlled using good combustion practices. Particulate and VOC emissions will be minimized through the use of natural gas as the fuel. Specifications for the new boilers are summarized in Table 5.1-13. For the Ivanpah 1 and 2, the boiler will be a Nebraska boiler D-type NSX-G-120 or equivalent; for Ivanpah 3, the boiler will be Babcock Wilcox, field-erected, two passes, or equivalent. Each boiler will be provided with a Natcom Low-NO_x burner and 20 percent Flue Gas Recirculation, to guarantee a maximum NO_x emission of 9 ppm.

TABLE 5.1-13
Natural Gas Boiler Specifications

	Ivanpah 1 and 2	Ivanpah 3
Make and Mode	Nebraska boiler D-type NSX-G-120 or equivalent	Babcock Wilcox or equivalent
Fuel	Natural gas	Natural gas
Maximum Boiler Heat Input Rate	231.1 MMBtu/hr @ HHV	462.2 MMBtu/hr @ HHV
Steam Production Rate	220,000 lb/hr	440,000 lb/hr
Stack Exhaust Temperature	430°F	430°F
Exhaust Flow Rate	78,538 acfm	157,076 acfm
Exhaust O_2 Concentration, dry volume	2.80%	2.80%
Exhaust CO_2 Concentration, dry volume	10.28%	10.28%

TABLE 5.1-13
Natural Gas Boiler Specifications

	Ivanpah 1 and 2	Ivanpah 3
Exhaust Moisture Content, wet volume	17.58%	17.58%
Exhaust Moisture Content, wet volume	17.58%	17.58%
Emission Controls	Low-NO_x Burner (9.0 ppmvd NO_x @ 3% O_2); combustion controls (4.0 ppmv CO; 2.0 ppmv VOC @ 3% O_2)	

A typical analysis for the natural gas fuel to be used by the boilers is summarized in Table 5.1-14.

TABLE 5.1-14
Nominal Fuel Properties – Natural Gas

Component Analysis		Chemical Analysis	
Component	Average Concentration, Volume	Constituent	Percent by Weight
Methane (CH_4)	95%	Carbon (C)	72.80%
Ethane (C_2H_6)	2%	Hydrogen (H)	23.79%
Nitrogen (N_2)	2%	Nitrogen (N)	1.08%
Carbon Dioxide (CO_2)	1%	Oxygen (O)	2.33%
		Sulfur (S)	0.25 gr/100 scf (annual average)
		Higher Heating Value	1,027 Btu/scf

Each plant will have a diesel-fueled emergency generator sized to operate the feedwater pumps and the boiler circulation pumps. This analysis is based upon use of a single Caterpillar CAT 3516C-HD TA diesel Engine (3,350 horsepower) each for Ivanpah 1 and 2, and two such engines for Ivanpah 3.

Each plant will also have a diesel-fueled emergency fire water pump engine rated at 240 horsepower with a maximum fuel consumption rate of 10.3 gallons per hour.

5.1.6.2 Facility Operations

The boilers will be operated under two conditions: in the morning, to bring the system up to operating temperature; and during the day when a cloud passes over the sun. The average daily use of the boilers will be less than an hour. Daily maximum impacts from boiler operations were calculated assuming that each boiler would be fired no more than four hours on any given day.

Emergency engines will be tested to ensure that they will function when needed. In order to provide maximum flexibility, it was assumed that each engine would use the 50 hours of testing allowed under the state stationary engine ATCM. It was also assumed that only one engine would be tested at any given time.

Heat input limits, as summarized in Table 5.1-15, correspond to the proposed unit and facility emission limits.

Emissions and operating parameters for the boilers are shown in Appendix 5.1B, Table 5.1B-1. Emissions and operating parameters for the emergency engines are shown in Appendix 5.1B, Table 5.1B-2. Emissions and operating parameters for the fire pump engines are shown in Appendix 5.1B, Table 5.1B-3.

TABLE 5.1-15
Maximum Facility Fuel Use (Boilers)

Period	Ivanpah 1 and 2 (each)	Ivanpah 3	Total Fuel Use
Per Hour	231	462	924
Per Day	924	1,848	3,696
Per Year	120,000	240,000	480,000

5.1.6.3 Emissions Calculations

This section presents calculations of emissions increases from the proposed new Ivanpah boilers and engines. Tables containing the detailed calculations are included in Appendix 5.1B.

5.1.6.3.1 Criteria Pollutant Emissions: Boilers

The boiler, emergency engine, and diesel fire pump engine emission rates have been calculated from vendor data, project design criteria, and established emission calculation procedures. The emission rates for the boilers are shown in the following tables. The emission rates for the diesel emergency and fire pump engines are shown in Tables 5.1B-2 of Appendix 5.1B.

Boiler Emissions during Normal Operations

Emissions of NO_x, CO, and VOC were calculated from emission limits (in ppmv @ 3 percent O_2) and the exhaust flow rates. The NO_x emission limit reflects the use of low-NO_x burners. The VOC and CO emission limits reflect the use of good combustion practices. SO_x, PM_{10} and $PM_{2.5}$ emission rates are based on the use of natural gas as the fuel and good combustion practices.

Maximum emissions are based on the highest heat input rate shown in Table 5.1-15.

SO_x emissions were calculated from the heat input (in MMBtu) and a SO_x emission factor (in lb/MMBtu). The short-term SO_x emission factor of 0.0021 lb/MMBtu was derived from the maximum allowable (i.e., tariff limit) fuel sulfur content of 0.75 grains per 100 standard cubic feet (gr/100 scf). The annual average SO_x emissions were based on the expected annual average sulfur grain loading of 0.25 gr/100 scf.

Maximum hourly PM_{10} emissions are based on design specifications. $PM_{2.5}$ emissions were determined based on the assumption that all boiler exhaust particulate is less than 2.5 microns in diameter.

Emissions for the boilers are summarized in Table 5.1-16.

TABLE 5.1-16
Maximum Hourly Emission Rates: Boilers

Pollutant	ppmvd @ 3% O_2	lb/MMBtu	lb/hr
Ivanpah 1 and 2 (each)			
NO_x	9.0	0.011	2.5
SO_2 *	1.7	0.003	0.6
CO	25.0	0.018	4.2
VOC	1.4	0.0006	0.1
PM_{10}	n/a	0.007	1.7
Ivanpah 3			
NO_x	9.0	0.011	5.0
SO_2*	1.7	0.003	1.3
CO	25.0	0.018	8.5
VOC	1.4	0.0006	0.3
PM_{10}	n/a	0.007	3.4

* Based on maximum natural gas sulfur content of 0.75 grains/100 scf.

5.1.6.3.2 Ivanpah Criteria Pollutant Emissions Summary

The calculation of maximum facility emissions shown in Table 5.1-17 is based on the boiler emission rates shown in Table 5.1-16, the fuel energy use limitations in Table 5.1-15, and the following assumptions:

1. Each boiler may operate up to 4 hours per day.
2. Each engine may be tested for up to one hour on a single day. No two engines may be tested at the same time.
3. Worst-case annual emissions: 520 hours per year for boilers, 50 hours per year for each engine.

The Ivanpah boilers will not have higher emissions during startup and shutdown, because the NO_x control system (low-NO_x burners) will effectively reduce emissions at all times. As a result, the system will not require special conditions allowing a higher emission rate during startup and shutdown.

Likewise, during plant commissioning, the mass emissions can be kept below the levels upon which this analysis is based. If the stack concentration is higher than 9 ppm during commissioning, before the boiler's operation is properly tuned, it is not likely to be much higher, and total emissions can be kept below normal operating limits by reduced firing.

Emissions during boiler commissioning would be limited to the hourly and daily maxima included in Table 5.1-17.

Full power operation, not startup or commissioning, is therefore the worst case for emissions.

The assumptions used in calculating maximum hourly, daily and annual emissions from the new facility are shown in Appendix 5.1B, Tables 5.1B-3 and 5.1B-4.

TABLE 5.1-17
Maximum Emissions From New Equipment

	Pollutant				
Emissions/Equipment	**NO_x**	**SO_2**	**CO**	**VOC**	**PM_{10}**
Maximum Hourly Emissions					
Boilers	10.0	2.6	16.9	0.5	6.8
Emergency Engines	41.8	0.1	6.8	1.7	0.6
Diesel Fire Pump Engines	0.0	0.0	0.0	0.0	0.0
Total, pounds per hour	**51.8**	**2.7**	**23.5**	**2.2**	**7.4**
Maximum Daily Emissions					
Boilers	40.0	10.3	67.7	2.2	27.4
Emergency Engines	167.0	0.1	13.5	3.3	1.2
Diesel Fire Pump Engines	7.0	0.0	1.0	0.8	0.1
Total, pounds per day	**214.0**	**10.4**	**82.2**	**6.3**	**28.7**
Maximum Annual Emissions					
Boilers	2.6	0.7	4.4	0.1	1.8
Emergency Engines	4.2	0.3	0.3	0.1	0.0
Diesel Fire Pump Engines	0.2	0.0	0.0	0.0	0.0
Total, tons per year	**7.0**	**1.0**	**4.7**	**0.2**	**1.8**

The maximum hourly, daily and annual emissions in Table 5.1-17 are used in the air dispersion modeling to calculate the maximum potential ground-level concentrations contributed by the project to the ambient air.

5.1.6.3.3 Evaluation of Potential PSD Applicability

For the purposes of determining applicability of the PSD program requirements, the following regulatory procedure is used. Proposed Ivanpah emissions are compared with regulatory significance thresholds to determine whether the facility is major and thus may be subject to PSD. If the facility emissions exceed these thresholds, it is a major facility. The comparison in Table 5.1-18 indicates that the Ivanpah SEGS would not be a major source because its emissions of all pollutants are significantly below the 100-ton-per-year major source threshold.

TABLE 5.1-18
Comparison of Ivanpah Emissions with PSD Major Source Thresholds

Pollutant	Maximum Annual Ivanpah Emissions (tpy)	PSD Major Source Threshold (tpy)	Is Facility a Major Source?
NO_2	3.4	100	No
SO_2	0.7	100	No
CO	4.5	100	No
PM_{10}	1.8	100	No

5.1.6.3.4 Non-Criteria Pollutant Emissions

Maximum hourly and annual noncriteria pollutant (toxic air contaminant [TAC]) emissions were estimated for the proposed boilers, emergency generators, and emergency fire pumps. Maximum proposed TAC emissions for the boilers are shown in Table 5.1-19, and were calculated from the heat input rate (in MMBtu/hr and MMBtu/yr) shown in Table 5.1-15, EPA emission factors (in lb/MMscf), and the nominal higher heating value for the natural gas of 1,027 Btu/scf.

TABLE 5.1-19
Toxic Air Contaminant Operating Emissions for the Ivanpah SEGS Project

Compound	Emission Factor (lb/mmcf)	Maximum Proposed Emissions	
		lb/hr	tpy
Boilers[a]			
Benzene	0.0021	0.0	0.000
Formaldehyde	0.075	0.1	0.009
Hexane	1.8	1.6	0.204
Naphthalene	0.00061	0.0	0.000
Polycyclic Aromatics	0.00010	0.0	0.000
Toluene	0.0034	0.0	0.000
Emergency Engines[b]			
Diesel Particulate		1.2	0.030
Fire Pump Engines[b]			
Diesel Particulate		0.1	0.004

[a] Emission factors obtained from AP-42 Table 1.4-3.
[b] All PM_{10} emissions from diesel engines are TACs.

Because diesel particulate matter is considered to be a TAC, all of the PM_{10} emissions from the diesel emergency engines and diesel fire pump engines are also included. (These are shown in Table 5.1-17, with supporting calculations shown in Appendix 5.1B, Tables 5.1B-3, 5.1B-4, and 5.1B-5.) The ambient impact of these non-criteria pollutant emissions is determined by the potential health risks calculated in the screening health risk assessment (see Section 5.1.6.4).

Detailed calculations of the TAC emissions from the facility are shown in Appendix 5.1B, Tables 5.1B-5, 5.1B-6, and 5.1B-7.

As emissions of each individual HAP are below 10 tons per year and total HAP emissions are below 25 tons per year, the project is not subject to the Maximum Achievable Control Technology (MACT) requirements of 40 CFR Part 63.

5.1.6.3.5 Construction Emissions

Ivanpah SEGS is comprised of three facilities. The phasing is planned so that Ivanpah 1 (the southernmost site) will be constructed first, followed by Ivanpah 2 (the middle site), then Ivanpah 3 (the 200-MW plant on the north), though the order of construction may change.

Each plant has a 24-month construction schedule. This analysis is based on the assumption that the last 12 months of construction of Ivanpah 1 will overlap with the first 12 months of construction of Ivanpah 2, and that the last 12 months of construction of Ivanpah 2 will overlap with the first twelve months of construction of Ivanpah 3.

The construction schedule for each phase is broken down into several activities : mobilization (2 months), during which the site is set up to support the equipment and workers that will be on the site; clean and grub (5 months) during which vegetation is removed from the heliostat field, and the terrain is smoothed (not, however, graded, except for the power block area); heliostat erection (13 months); power block and tower construction (14 months, beginning at the same time as heliostat erection); and commissioning and testing (3 months), beginning when heliostat erection and power block construction are complete.

There are two types of construction emissions: fugitive dust and combustion emissions. Fugitive dust comes from moving, disturbing, and traveling over the work site and roads. The largest contribution to dust emissions comes from workers commuting to and from the site on two miles of dirt road. Commute emissions (dust and combustion) will be minimized by use of shuttle buses that will transport workers from Las Vegas to the project site. Other activities that create dust include scraping and grading of the site, earth moving, and the movement of various construction vehicles around the site.

Combustion emissions come from the workers' vehicles, from heavy equipment (both stationary and mobile), and from delivery vehicles.

A detailed construction schedule, with monthly estimates of the equipment in use and staff on site, is included in Appendix 5.1F. A discussion of construction emissions and modeled impacts is included in Section 5.1.6.6.

5.1.6.4 Air Quality Impact Analysis

The air quality impact analysis for the Ivanpah SEGS subjects the emissions presented above to ambient air dispersion modeling and health risk assessment. In addition, the CEC requires various ambient air quality impact analyses, and those analyses are presented in this section.

5.1.6.4.1 Air Quality Modeling Methodology.

An assessment of impacts from the Ivanpah SEGS on ambient air quality has been conducted using the EPA-approved air quality dispersion models. These models use a mathematical description of atmospheric turbulent entrainment and dispersion to simulate the actual processes by which a pollutant emission is transported to potential ground-level impact areas.

Using the most stringent and conservative assumptions, dispersion modeling was used to determine the maximum ground-level impacts of the Ivanpah plants. The results were compared with state and federal ambient air quality standards and PSD significance levels. If the standards are not exceeded in the analysis, then the facility will cause no exceedances under any operating or ambient conditions, at any location, under any meteorological conditions. In accordance with the air quality impact analysis guidelines developed by EPA[7] and CARB[8], the ground-level impact analysis includes the following assessments:

- Impacts in simple, intermediate, and complex terrain
- Aerodynamic effects (downwash) due to nearby building(s) and structures
- Impacts from inversion breakup (fumigation)

Simple, intermediate, and complex terrain impacts were assessed for all meteorological conditions that would limit the amount of final plume rise. Plume impaction on elevated terrain, such as on the slope of a nearby hill, can cause high ground-level concentrations, especially under stable atmospheric conditions. Another dispersion condition that can cause high ground-level pollutant concentrations is caused by building downwash. A stack plume can be downwashed when wind speeds are high and a sufficiently tall building or structure is in close proximity to the emission stack. This can result in building wake effects where the plume is drawn down toward the ground by the lower pressure region that exists in the lee (downwind) side of the building or structure.

Fumigation conditions occur when the plume is emitted into a layer of stable air (inversion) that then becomes unstable from below, resulting in a rapid mixing of pollutants out of the stable layer and towards the ground in the unstable layer underneath. The low mixing height that results from this condition allows little diffusion of the stack plume before it is carried downwind to the ground. Although fumigation conditions are short-term, rarely lasting as long as an hour, relatively high ground-level concentrations may be reached during that period. Fumigation tends to occur under clear skies and light winds, and is more prevalent in summer.

The basic model equation used in this analysis assumes that the concentrations of emissions within a plume can be characterized by a Gaussian (statistical) distribution around the centerline of the plume. Concentrations at any location downwind of a point source such as a stack can be determined from the following equation:

$$C(x,y,z,H) = \left(\frac{Q}{2\pi\sigma_y\sigma_z u}\right) * \left(e^{-1/2\left(y/\sigma_y\right)^2}\right) * \left[\left\{e^{-1/2\left(z-H/\sigma_z\right)^2}\right\} + \left\{e^{-1/2\left(z+H/\sigma_z\right)^2}\right\}\right] \qquad \text{(Eq. 1)}$$

---

[7] EPA. Guideline on Air Quality Models, 40 CFR Part 51, Appendix W.

[8] ARB. Reference Document for California Statewide Modeling Guideline, April 1989.

Where:

C	=	pollutant concentration in the air
Q	=	pollutant emission rate
$\sigma_y \sigma_z$	=	horizontal and vertical dispersion coefficients, respectively, at downwind distance x
u	=	wind speed at the height of the plume center
x,y,z	=	variables that define the downwind, crosswind, and vertical distances from the center of the base of the stack in the model's 3-dimensional Cartesian coordinate system
H	=	the height of the plume above the stack base (the sum of the height of the stack and the vertical distance that the plume rises due to the momentum and thermal buoyancy of the plume)

Gaussian dispersion models are approved by EPA for regulatory use and are based on conservative assumptions (i.e., the models tend to overpredict actual impacts by assuming steady-state conditions, no pollutant loss through conservation of mass, no chemical reactions). The EPA models were used to determine if ambient air quality standards would be exceeded, and whether a more accurate and sophisticated modeling procedure would be warranted to make the impact determination. The following sections describe:

- Screening modeling procedures
- Refined air quality impact analysis
- Existing ambient pollutant concentrations and preconstruction monitoring
- Results of the ambient air quality modeling analyses
- PSD increment consumption

Modeling for this project was performed in accordance with the modeling protocol submitted to and approved by the MDAQMD and the CEC staff. The modeling procedures used for each type of modeling analysis are described in more detail in the following sections.

Two different EPA guideline models were used for different meteorological conditions in the ambient air quality impact analysis.

The EPA-approved AERMOD[9] model was used to evaluate impacts in simple, intermediate, and complex terrain. AERMOD is a Gaussian dispersion model capable of assessing impacts from a variety of source types in areas of simple, intermediate, and complex terrain. The model can account for settling and dry deposition of particulates; area, line, and volume source types; downwash effects; and gradual plume rise as a function of downwind distance. The model is capable of estimating concentrations for a wide range of averaging times (from one hour to one year), and was applied with two years of actual meteorological data recorded at Jean, Nevada. AERMOD replaces the previously EPA-recommended

[9] The acronym AERMOD was derived from American Meteorological Society/Environmental Protection Agency Regulatory Model.

model, Industrial Source Complex, Version 3 (ISC3), which has been used for many years for air quality impact analyses in CEC AFCs.

The SCREEN3 model was used to evaluate boiler impacts under inversion breakup conditions because these are special cases of meteorological conditions. The SCREEN3 model uses a range of meteorological conditions that could occur under inversion breakup and shoreline fumigation. The fumigation analysis is discussed in more detail below.

5.1.6.4.2 Air Quality Impact Analysis

In simple, intermediate and complex terrain, AERMOD was used to estimate project impacts. The AERMOD model was used to calculate 1-hour, 3-hour, 8-hour, 24-hour, and annual average concentrations.

Modeling was performed in two phases: coarse grid modeling and fine grid modeling. Preliminary modeling was performed with the coarse grid to locate the areas of maximum concentration. Fine grids were used to refine the location of the maximum concentrations.

Inputs required by AERMOD include the following:

- Model options
- Meteorological data
- Source data
- Receptor data

Standard AERMOD control parameters were used, including stack tip downwash, non-screening mode, non-flat terrain, and sequential meteorological data check. Stack-tip downwash, which adjusts the effective stack height downward following the methods of Briggs (1972) for cases where the stack exit velocity is less than 1.5 times the wind speed at stack top, was selected per EPA guidance.

AERMOD uses hourly meteorological data to characterize plume dispersion. The required emission source data inputs to both models used in this analysis include source locations, source elevations, stack heights, stack diameters, stack exit temperatures and velocities, and emission rates. The source locations are specified for a Cartesian (x,y) coordinate system where x and y are distances east and north in meters, respectively. The Cartesian coordinate system used is the Universal Transverse Mercator Projection (UTM). The stack height that can be used in the model is limited by federal Good Engineering Practice (GEP) stack height restrictions, discussed in more detail below. In addition, Building Profile Input Program – Plume Rise Model Enhancements (BPIP-PRIME, current version 95086) requires nearby building dimension data to calculate the impacts of building downwash.

For the purposes of modeling, a stack height beyond what is required by GEP is not allowed. However, this requirement does not place a limit on the actual constructed height of a stack. GEP as used in modeling is the height necessary to assure that emissions from the stack do not result in excessive concentrations of any air pollutant in the immediate vicinity of the source as a result of atmospheric downwash, eddies, or wakes that may be created by the source itself, nearby structures, or nearby terrain obstacles. In addition, the GEP modeling restriction assures that any required regulatory control measure is not compromised by the effect of that portion of the stack that exceeds the GEP. EPA guidance[10] for determining GEP stack height indicates that GEP is the greater of 65 meters or H_g, where H_g is calculated as follows:

$$H_g = H + 1.5L$$

where:

H_g = Good Engineering Practice stack height, measured from the ground-level elevation at the base of the stack

H = height of nearby structure(s) measured from the ground-level elevation at the base of the stack

L = lesser dimension, height or maximum projected width, of nearby structure(s)

In using this equation, the guidance document indicates that both the height and width of the structure are determined from the frontal area of the structure, projected onto a plane perpendicular to the direction of the wind.

For regulatory applications, a building is considered sufficiently close to a stack to cause wake effects when the downwind distance between the stack and the nearest part of the building is less than or equal to five times the lesser of the height or the projected width of the building. Building dimensions for the buildings analyzed as downwash structures were obtained from plot plans. The building dimensions were analyzed using the BPIP-PRIME to calculate 36 wind-direction-specific building heights and projected building widths for use in building wake calculations. The building dimensions used in the GEP analysis are shown in Appendix 5.1D, Table 5.1D-1.

The stack parameters and emission rates used to model combined impacts from all equipment at the new facility are shown in Appendix 5.1D, Table D-4. The model receptor grids were derived from U.S. Geological Survey (USGS) 30-meter Digitized Elevation Map (DEM) data. CEC guidance was used to locate receptors. Twenty-five-meter refined receptor grids were used in areas where the coarse grid analyses indicated modeled maxima for each site plan would be located. A map showing the layout of the receptor grid around the site plan is presented in Appendix 5.1D, Figure D-2.

Terrain features were taken from USGS DEM data and 7.5-minute quadrangle maps of the area including Mesquite Lake, State Line Pass, Roach, Pachalka Spring, Clark Mountain, Ivanpah, Desert, Valley Wells, Mescal Range, Mineral Hill, and Nipton. Receptors were placed in a mixed 250-meter resolution coarse grid and a semi-coarse near-facility grid at 100-meter resolution.

5.1.6.4.3 Specialized Modeling Analyses

Fumigation Modeling

Fumigation occurs when a stable layer of air lies a short distance above the release point of a plume and unstable air lies below. Under these conditions, an exhaust plume may cause high ground-level pollutant concentrations because the plume is unable to rise upwards normally due to the stable layer capping it from above, and be drawn to the ground by

[10] EPA. Guideline for Determination of Good Engineering Practice Stack Height, Revised June 1985.

turbulence within the unstable layer. Although fumigation conditions rarely last as long as one hour, relatively high ground-level concentrations may be reached during that time. For this analysis, fumigation was assumed to occur for up to 90 minutes as required by EPA guidance.

The SCREEN3 model was used to evaluate maximum ground-level concentrations for short-term averaging periods (24 hours or less). Guidance from the EPA[11] was followed in evaluating fumigation impacts. The maximum fumigation impact from the boilers occurred approximately 6.6 to 9.1 km from the facility. This analysis, which is shown in more detail in Appendix 5.1D, Table D-5, showed that, with the exception of 24 hour PM_{10} and $PM_{2.5}$ impacts, impacts under fumigation conditions are less than the maximum impacts during normal equipment operation.

Ozone Limiting

In accordance with the procedure followed for similar projects, 1-hour NO_2 impacts during project construction and project operation were modeled using the Plume Volume Molar Ratio Method (PVMRM) adaptation of the Ozone Limiting Method (Cole and Summerhays, 1979).

Hourly ozone data collected at the Barstow monitoring stations during the years 2001-2002 was used in conjunction with PVMRM to calculate hourly NO_2 concentrations from hourly NO_x concentrations. The PVMRM involves an initial comparison of the estimated maximum NO_x concentration and the ambient O_3 concentration left in the plume after reaction of NO with O_3 to determine which is the limiting factor to NO_2 formation. If the remaining O_3 concentration is greater than the maximum NO_x concentration, total conversion is assumed. If the NO_x concentration is greater than the remaining O_3 concentration, the formation of NO_2 is limited by the remaining ambient O_3 concentration. In this case, the NO_2 concentration is set equal to the O_3 concentration plus a correction factor that accounts for in-stack and near-stack thermal conversion.

The peak NO_2 concentrations are overwhelmingly dominated by emergency engine testing. Emergency engine testing will be limited to one hour per engine on any given day. Only one engine will be tested at any given time

5.1.6.4.4 Results of the Ambient Air Quality Modeling Analyses

Table 5.1-20 summarizes the maximum impacts from the Ivanpah SEGS, calculated from the refined and fumigation modeling analyses described above.

5.1.6.4.5 Ambient Air Quality Impacts from the Project

To determine a project's air quality impacts, the modeled concentrations are added to the maximum background ambient air concentrations and then compared to the applicable ambient air quality standards. The maximum background ambient concentrations are listed in the following text and tables. A discussion of why the data collected at these stations are representative of ambient concentrations in the vicinity of the project was provided above.

[11] EPA, October 1992.

Table 5.1-21 presents the maximum concentrations of NO_2, CO, SO_2, PM_{10}, and $PM_{2.5}$ recorded between 2004 and 2006 from nearby monitoring stations, as required by Appendix B(g)(8)(G) of the CEC guidelines.

TABLE 5.1-20
Air Quality Modeling Results

Pollutant	Averaging Time	Modeled Maximum Concentrations ($\mu g/m^3$)	
		Normal Operations AERMOD	**Fumigation SCREEN3**
NO_2	1-hour	123.7	4.4
	Annual	0.0	*
SO_2	1-hour	4.1	1.1
	3-hour	1.1	0.9
	24-hour	0.0	0.1
	Annual	0.0	*
CO	1-hour	73.3	7.4
	8-hour	1.6	2.5
$PM_{2.5}/PM_{10}$	24-hour	0.1	0.2
	Annual	0.0	*

* Not applicable, because inversion breakup is a short-term phenomenon and as such is evaluated only for short-term averaging periods.

TABLE 5.1-21
Maximum Background Concentrations, 2004-2006 ($\mu G/M^3$)

Pollutant	Averaging Time	Monitoring Site	Year	Value
NO_2	1-hour	Barstow	2004	190.1
	Annual	Barstow	2004	43.3
SO_2	1-hour	Trona	2006	60.3
	3-hour	Trona	2006	44.5
	24-hour	Trona	2004	13.1
	Annual	Trona	2006	2.6
CO	1-hour	Barstow	2006	4,010
	8-hour	Barstow	2005	1,535
PM_{10}	24-hour	Trona	2006	184.4
	Annual	Barstow	2005	25.4
$PM_{2.5}$	24-hour[a]	Big Bear	2003[b]	28.8
	Annual	Big Bear	2003[b]	10.6

Source: California Air Quality Data, California Air Resources Board website; EPA AIRData website. Reported values have been rounded to the nearest tenth of a $\mu g/m^3$.

[a] 24-hour average $PM_{2.5}$ concentrations shown are 98th percentile values rather than highest values because compliance with the ambient air quality standards is based on 98th percentile readings.

[b] Data not available for 2004-2005.

The maximum modeled concentrations in Table 5.1-20 are combined with the maximum background ambient concentrations in Table 5.1-21 and compared with the state and federal ambient air quality standards in Table 5.1-22. Using the conservative assumptions described earlier, the results indicate that Ivanpah operating emissions will not cause or contribute to violations of state or federal air quality standards.

Existing 24-hour average PM_{10} background concentrations and PM_{10} and $PM_{2.5}$ annual background concentrations already exceed state standards. However, PM_{10} and $PM_{2.5}$ impacts from Ivanpah operations are very small, and will not contribute significantly to the exceedance of an AAQS. The following discussion demonstrates that impacts from the proposed project will not exceed significant impact levels.

TABLE 5.1-22
Modeled Maximum Impacts

Pollutant	Averaging Time	Maximum Facility Impact (μg/m^3)	Background (μg/m^3)	Total Impact (μg/m^3)	State Standard (μg/m^3)	Federal Standard (μg/m^3)
NO_2	1-hour	123.7	190.1	313.8	470[a]	—
	Annual	0.0	43.3	43.3	[a]	100
SO_2	1-hour	4.1	60.3	64.4	650	—
	3-hour	1.1	44.5	45.6	—	1,300
	24-hour	0.0	13.1	13.1	109	365
	Annual	0.0	2.6	2.6	—	80
CO	1-hour	73.3	4,010	4083.3	23,000	40,000
	8-hour	1.6	1,535	1536.6	10,000	10,000
PM_{10}	24-hour	0.2 [b]	184.4	184.6	50	150
	Annual	0.0	25.4	25.4	20	—
$PM_{2.5}$	24-hour	0.2[b]	28.8	30.0	—	35
	Annual	0.0	10.6	10.6	12	15

[a] State has adopted a new 1-hour NO_x standard of 0.18 ppm (338 μg/m^3) and an annual NO_x standard of 0.030 ppm (56 μg/m^3) that are awaiting OAL approval before implementation.

[b] Maximum 24-hour PM_{10} and $PM_{2.5}$ impacts occur under fumigation conditions.

5.1.6.4.6 PSD Increment Consumption

The Prevention of Significant Deterioration (PSD) program was established to allow emission increases (increments of consumption) that do not result in significant deterioration of ambient air quality in areas where criteria pollutants have not exceeded the NAAQS. As discussed in Section 5.1.2.3, the project is not subject to PSD review. However, an analysis is conducted here to determine whether the ambient impacts of the proposed project exceed the PSD significance thresholds, as these thresholds are generally used as one measure of whether the project's ambient impacts will be significant. Modeled project impacts are compared with the PSD significance thresholds in Table 5.1-23 below.

TABLE 5.1-23
Comparison of Maximum Modeled Impacts and PSD Significant Impact Levels

Pollutant	Averaging Time	Significant Impact Level, μg/m^3	Maximum Modeled Impact for Ivanpah, μg/m^3	Exceed Significant Impact Level?
NO_2	Annual	1	0.0	No
SO_2	3-hour	25	1.1	No
	24-hour	5	0.0	No
	Annual	1	0.0	No
CO	1-hour	2,000	73.3	No
	8-hour	500	1.6	No
PM_{10}	24-hour	5	1.1	No
	Annual	1	0.0	No

5.1.6.4.7 Preconstruction Monitoring

Because the Ivanpah SEGS is not subject to PSD review, EPA will not require preconstruction ambient air quality monitoring data for the purposes of establishing background pollutant concentrations in the impact area.

5.1.6.5 Screening Health Risk Assessment

The screening health risk assessment (SHRA) was conducted to determine expected impacts on public health of the noncriteria pollutant emissions from the operation of three boilers and six diesel engines. The SHRA was conducted in accordance with the OEHHA's "Air Toxics Hot Spots Program Guidance Manual For Preparation of Health Risk Assessments" (October 2003).

The SHRA estimated the offsite potential Maximum Incremental Cancer Risk (MICR) at the point of maximum impact, at the location (e.g., residence) of the maximally exposed individual (MEI) and to the maximally exposed worker (MEW), and the potential long-term (chronic) and short-term (acute) non-carcinogenic health impacts from non-carcinogenic emissions. The CARB/OEHHA-approved Hotspots Analysis and Reporting Program (HARP) (Version 1.3) was used to evaluate multipathway exposure to non-criteria pollutant emissions. The individual pollutant carcinogenic risks are assumed to be additive. Because of the conservatism (overprediction) built into the established risk analysis methodology, the actual risks will be lower than those estimated.

The SHRA utilized the following information:

- Inhalation cancer potency factors for the carcinogenic emissions
- Noncancer Reference Exposure levels (RELs) for determining chronic and acute non-carcinogenic health impacts
- 1-hour and annual average emission rates for each non-criteria pollutant
- The modeled maximum offsite concentration of each non-criteria pollutant emitted

Many of the carcinogenic compounds also have non-carcinogenic health effects and are therefore included in the determination of both potential carcinogenic and noncarcinogenic effects. RELs are used as indicators of potential non-carcinogenic adverse health effects. RELs are generally based on the most sensitive adverse health effect reported and are designed to protect the most sensitive individuals. However, exceeding the REL does not automatically indicate a health impact. The OEHHA RELs were used to determine potential adverse health effects from noncarcinogenic compounds. A potential chronic health hazard index for each relevant non-carcinogenic pollutant is then determined by the ratio of the pollutant maximum annual average concentration to its respective REL. Similarly, a potential acute health hazard index for each relevant non-carcinogenic pollutant is determined by the ratio of the pollutant maximum 1-hour average concentration to its respective REL. The individual indices are summed to determine the overall hazard index for the project. Because noncarcinogenic compounds target different internal systems or organs (e.g., respiratory system, nervous system, eyes), this sum is considered conservative.

The SHRA results are compared with the established risk management procedures for the determination of acceptability. The established risk management criteria include those listed below.

- If the MICR is less than one in one million, the facility risk is considered not significant.
- If the MICR is greater than one in one million but less than ten in one million and Toxics BACT has been applied to reduce risks, the facility risk is considered acceptable.
- If the MICR is greater than ten in one million but less than 100 in one million and there are mitigating circumstances that, in the judgment of a regulatory agency, outweigh the risk, the risk is considered acceptable.
- For non-carcinogenic effects, total hazard indices of one or less are considered not significant.
- For a hazard index greater than one, OEHHA, the CEC and the MDAQMD may conduct a more refined review of the analysis and determine whether the impact is acceptable.

The SHRA includes the noncriteria pollutants listed above in Table 5.1-19. The receptor grid described earlier for criteria pollutant modeling was used for the SHRA. The potential health risks are presented in Table 5.1-24, and the detailed calculations are provided in Appendix 5.1E. The locations of the maximum modeled risks are shown in Appendix 5.1E, Figure 5.1E-1.

TABLE 5.1-24
Potential Health Risks from the Operation of Ivanpah SEGS

	Significance Thresholds	Ivanpah SEGS	Significant?
Maximum Incremental Cancer Risk (MICR) at Point of Maximum Impact	10 in one million	0.084 in one million	No
Acute Inhalation Health Hazard Index	1.0	0.013	No
Chronic Inhalation Health Hazard Index	1.0	0.00001	No

The acute and chronic health hazard indices are well below 1.0, and hence, are not significant. The MICR is 0.08 in one million, well below the ten in one million limit for the project proposed with Toxics BACT. The project will not pose a significant health risk at any location, under any weather conditions, under any operating conditions.

5.1.6.6 Construction Impacts Analysis

The Ivanpah SEGS will be constructed in three phases, one for each facility. Each phase will take approximately 24 months to complete. Construction on Phase 1 (Ivanpah 1) will commence as soon as the project is approved. Construction on Phase 2 (Ivanpah 2) is expected to begin 15 months later. Construction on Phase 3 (Ivanpah 3) is expected to begin 11 months after that. Phase 1 should be completed before Phase 3 begins.

Each phase will start with five months of ground preparation. Vegetation will be removed from the power block area and the areas where heliostats will be located. The power block area will be graded flat. The heliostat fields will be "smoothed"—the basic contours of the land will be unchanged, including water drainage channels, but the peaks and valleys will not be as pronounced. One goal of site preparation activities is to minimize changes to water drainage characteristics.

Once the site has been prepared, the power block structures will be built and the heliostat arrays installed.

Emissions due to the construction phase of the project have been estimated, including an assessment of emissions from vehicle and equipment exhaust and the fugitive dust generated from material handling. Construction emissions are shown in Tables 5.1-25 and 5.1-26.

Construction activities must be controlled to ensure that offsite impacts are avoided. Typical dust minimization measures will be implemented to control potential emissions of fugitive dust during construction of the project. The dust minimization measures are listed in Appendix 5.1F.

A dispersion modeling analysis was conducted based on these emissions. A detailed analysis of the emissions and ambient impacts is included in Appendix 5.1F. The results of the analysis indicate that construction activities are not expected to cause an exceedance of state or federal ambient air quality standards. The direct maximum construction impacts of the project will be below the state and federal ambient air quality standards for criteria pollutants. Results are shown in Table 5.1-27.

However, The state 24-hour and annual PM_{10} standards are already exceeded in the absence of the construction emissions for the project. As shown in Table 5.1F-4, the incremental PM impacts from project construction are small relative to the existing background.

One set of measure frequently used by CEQA lead agencies to determine significance of air quality impacts is the federal PSD significance thresholds. Facilities with operating emissions that fall below these thresholds are deemed to have an insignificant impact for PSD purposes.

The modeled impacts from construction exceed the annual PSD significance level for NO_2 and the 24-hour significance level for PM_{10}. However, as has been noted, the PSD significance levels were established based on ongoing impacts from a facility's normal operations. Construction emissions, in contrast, are short term. The construction impacts from this project will not cause a new violation of the standard (the NO_2 standard will not be exceeded, and the background PM_{10} is already above the standard. All feasible mitigation measures have been included as part of the project design.

Onsite combustion diesel PM_{10} emission impacts from delivery trucks and other construction equipment have also been evaluated to demonstrate that the carcinogenic risk from construction activities will be below ten in one million at all receptors. This screening health risk assessment is also included in Appendix 5.1E.

TABLE 5.1-25
Maximum Daily Emissions During Construction, Pounds Per Day

	NO_x	CO	VOC	SO_x	PM_{10}	$PM_{2.5}$
Onsite						
Construction Equipment	363.36	116.74	22.96	1.01	13.35	13.35
Fugitive Dust	—	—	—	—	176.98	31.57
Offsite						
Worker Travel, Truck Deliveries*	108.09	376.47	37.69	0.99	77.06	12.65
Total Emissions						
Total	471.45	493.21	60.65	1.99	267.38	57.56

* Offsite emissions. Emissions from onsite worker travel and truck deliveries are included in the fugitive dust and construction equipment emissions.

TABLE 5.1-26
Peak Annual Emissions During Project Construction, Tons Per Year

	NO_x	CO	VOC	SO_x	PM_{10}	$PM_{2.5}$
Onsite						
Construction Equipment	29.91	9.93	1.97	0.07	1.17	1.17
Fugitive Dust	—	—	—	—	16.66	2.99
Offsite						
Worker Travel, Truck Deliveries*	9.07	33.02	3.30	0.08	5.99	1.39
Total Emissions						
Total	38.98	42.95	5.27	0.16	23.83	5.55

* Offsite emissions. Emissions from onsite worker travel and truck deliveries are included in the fugitive dust and construction equipment emissions.

TABLE 5.1-27
Modeled Maximum Construction Impacts (includes all onsite emissions)

Pollutant	Averaging Time	Maximum Facility Impact (μg/m^3)	Background (μg/m^3)	Total Impact (μg/m^3)	State Standard (μg/m^3)	Federal Standard (μg/m^3)
NO_2	1-hour Annual	124.5 1.2	190.1 43.3	314.6 44.5	470* *	— 100
SO_2	1-hour 3-hour 24-hour Annual	0.4 0.1 0.04 0.003	60.3 44.5 13.1 2.6	60.7 44.6 13.1 2.6	650 — 109 —	— 1300 365 80
CO	1-hour 8-hour	78.8 15.6	4,010 1,535	4089 1551	23,000 10,000	40,000 10,000
PM_{10}	24-hour Annual	6.7 0.7	184.4 25.4	191.1 26.1	50 20	150 —
$PM_{2.5}$	24-hour Annual	1.6 0.2	28.8 10.6	30.4 10.8	— 12	35 15

* State has adopted a new 1-hour NO_x standard of 0.18 ppm (338 μg/m^3) and an annual NO_x standard of 0.030 ppm (56 μg/m^3) that are awaiting OAL approval before implementation.

5.1.6.7 Greenhouse Gas Emissions

In 2006, the California Legislature adopted AB32, the California Global Warming Solutions Act of 2006. This landmark legislation started California on the path to reduce emissions of greenhouse gases (GHGs) in California to 1990 levels. The principal GHG is carbon dioxide, which is emitted primarily from the combustion of fossil fuels.

The legislation requires CARB to determine the 1990 levels, and to adopt regulatory and market mechanisms to bring California's emissions back down to those levels by 2020. The legislation does not require that individual facilities or sectors return to 1990 levels. It is expected that some sectors will achieve greater reductions, while others will not.

It is unlikely that California's entire program will have a measurable impact on global climate change. Rather, it is asserted that California's effort, in conjunction with similar efforts worldwide, could reduce or even eliminate the negative impacts associated with global climate change.

It follows that no individual project, or even the cumulative effects of all of the reasonably foreseeable projects in California, will have a measurable impact on global climate change. However, new emissions of carbon dioxide will make it more difficult for the state to meet its goal of reducing GHG emissions to 1990 levels.

State agencies are developing the plans and regulations necessary to achieve the GHG emission reductions required by AB32. The starting point of these plans is a projection of what emissions would be in 2020 if business went on as usual. A significant amount of new emissions in the "business as usual" scenario comes from increased demand for electricity in California.

Regulations already in place require that much of that increased demand be met by projects like Ivanpah: energy that does not derive from the combustion of fossil fuels. Although Ivanpah SEGS will require the use of natural gas to operate the boilers, less than 5 percent of the total energy will come from fossil fuels. 95 percent or more will come from the sun, a renewable, non-polluting source of energy.

Demand for electricity in California will not be affected by Ivanpah SEGS. Every megawatt-hour generated by Ivanpah SEGS, however, will displace a megawatt-hour that would otherwise have been generated by a more traditional (i.e., fossil-fuel-fired) source of electricity. Ivanpah SEGS will reduce the amount of new fossil-fuel-fired generation capacity that would otherwise have to be built. Ivanpah SEGS therefore represents a net reduction in GHG emissions.

Direct emissions of GHGs from Ivanpah SEGS are presented in Table 5.1-28. CO_2 emissions are based on mass and molecular balance calculations for the combustion of natural gas. Nitrous oxide and methane emissions are based on default emission factors for boilers in Table 5.3 of the California Climate Action Registry's *Power/Utility Reporting Protocol*. These factors, in turn, are based on EPA emission factors in AP-42.

TABLE 5.1-28
Annual Emissions of Greenhouse Gases

Pollutant	Emissions (metric ton//year)	CO_2 Equivalents (metric ton/yr)
CO_2	25,470	25,470
Nitrous Oxide	0.4901	145
Methane	0.4704	11
TOTAL	--	25,626

5.1.7 Cumulative Effects

A cumulative impact analysis determines if the combined impact of the proposed project and all other foreseeable projects will cause an exceedance of an ambient air quality standard or impede progress of the Mojave Desert Air Basin towards attainment of those standards. An analysis of potential cumulative air quality impacts that may result from the proposed Ivanpah SEGS and other reasonably foreseeable projects is required by the CEC. A protocol for performing the cumulative impacts analysis is presented in Appendix 5.1H; the analysis will be submitted upon receipt of the necessary data from the MDAQMD.

5.1.8 Mitigation Measures

The project's emissions are below the levels that require mitigation under MDAQMD regulations. BACT and offsets are not triggered. Modeling shows that the project will not result in any significant air quality impacts.

Every megawatt-hour generated by Ivanpah SEGS will displace a megawatt-hour that would otherwise have been generated by a more traditional (i.e., fossil-fuel-fired) source of electricity. Ivanpah SEGS will reduce the amount of new fossil-fuel-fired generation capacity that would otherwise have to be built. Ivanpah SEGS therefore represents a net reduction in emissions of all pollutants.

Table 5.1-29 compares the emissions from Ivanpah SEGS with the emissions that would occur if the energy provided by Ivanpah SEGS were provided by a new natural gas-fired combined cycle turbine utilizing Best Available Control Technology (assumptions: heat rate of 7,000 Btu/kW, 2 ppmv NO_x, 3 lb PM_{10} per 100 MW, 4 ppmv CO, 1.4 ppmv VOC, 0.0006 lb/MMBtu SO_2).

TABLE 5.1-29
Comparison of Emissions Between Ivanpah SEGS and a Well-Controlled Gas Turbine

	Pollutant				
Emissions/Equipment	NO_x	**SO_2**	**CO**	**VOC**	**PM_{10}**
Maximum Hourly Emissions, pounds per hour					
Ivanpah SEGS	58.8	2.7	28.7	3.0	7.5
Gas Turbine	20.6	16.8	25.1	5.0	12.0
Maximum Daily Emissions, pounds per day					
Ivanpah SEGS	88.8	10.4	75.5	4.7	28.1
Gas Turbine	330	269	402	80	192
Maximum Annual Emissions, Total, tons per year					
Ivanpah SEGS	7.0	1.0	4.7	0.2	1.8
Gas Turbine	24.8	20.2	30.1	6.0	14.4

5.1.9 Involved Agencies and Agency Contacts

Each level of government (state, federal, and county/local air district) has adopted specific regulations that limit emissions from stationary combustion sources, several of which are applicable to this project. The air agencies having permitting authority for this project are shown in Table 5.1-30. The applicable federal LORS and compliance with these requirements are discussed in more detail in Section 5.12.

TABLE 5.1-30
Agency Contacts for Ivanpah SEGS Air Quality

Agency	Authority	Contact
EPA Region 9	Permit issuance and oversight, enforcement	Gerardo Rios, Chief Permits Office EPA Region 9 75 Hawthorne Street San Francisco, CA 94105 (415) 744-1259
California Air Resources Board	Regulatory oversight	Mike Tollstrup, Chief Project Assessment Branch California Air Resources Board 2020 L Street Sacramento, CA 95814 (916) 322-6026
Mojave Desert Air Quality Management District	Permit issuance, enforcement	Eldon Heaston, Executive Director Mojave Desert Air Quality Management District 14306 Park Avenue Victorville, CA 92392

5.1.10 Permit Requirements and Permit Schedule

Agency-required permits related to air quality include the Acid Rain (Title IV) and Federal Operating (Title V) Permits, and the Mojave Desert Air Quality Management District Determination of Compliance (DOC). Upon approval of the project by the CEC, the DOC serves as the MDAQMD Authority to Construct. A Permit to Operate will be issued by the MDAQMD after construction and commencement of operation. An application for the Acid Rain permit must be submitted no less than 24 months before startup. An application for the Title V permit must be submitted within 12 months of startup.

The applicant anticipates that each of the three Ivanpah plants will be a separate facility under separate ownership and control. All three Ivanpah plants are being designed and developed by a single entity, and they will share some common utilities. Because the plants will be related, and in order to ensure that all cumulative impacts of their construction and operation are evaluated, a single application will be submitted for all three plants. Because each of the plants under separate ownership and control, it is expected that each of the plants will be permitted separately. This procedure will ensure that all impacts of the project as a whole are properly considered, that responsibility for compliance during operations is appropriately allocated, and that agency review of the project is efficient and complete.

5.1.11 References

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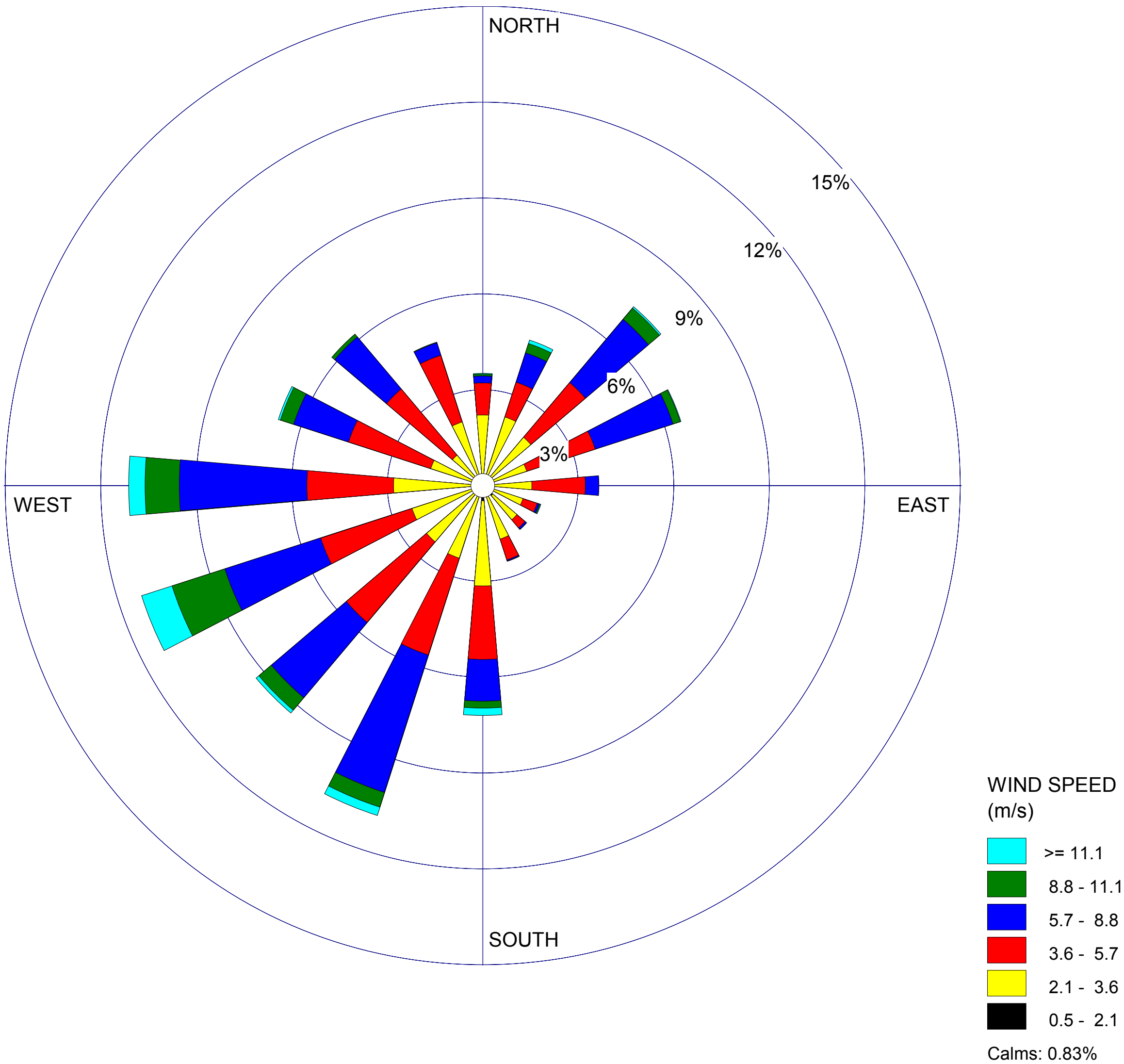

FIGURE 5.1-1
2001 ANNUAL WIND ROSE,
JEAN, NV
IVANPAH SOLAR ELECTRIC GENERATING SYSTEM

CH2MHILL

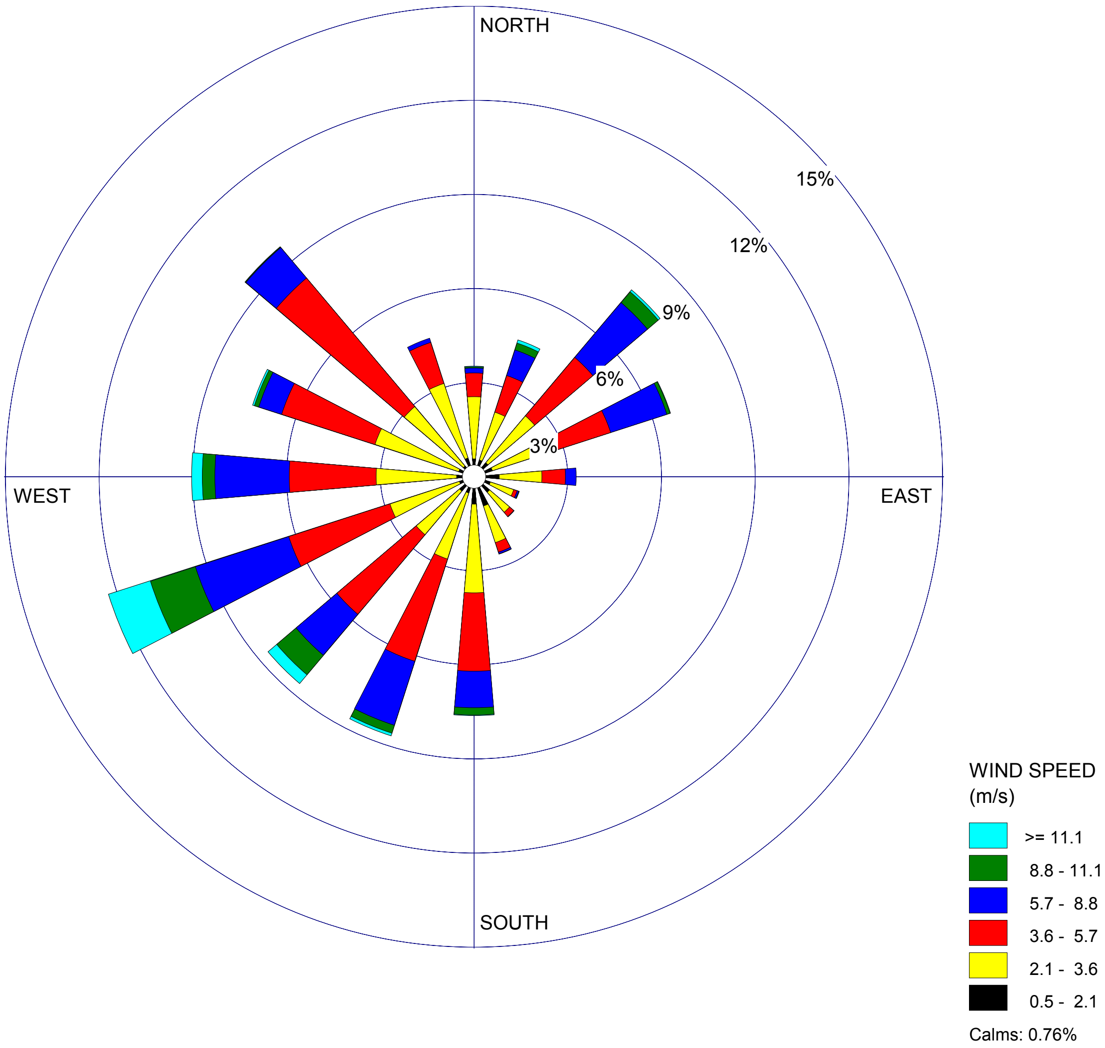

FIGURE 5.1-2
2002 ANNUAL WIND ROSE,
JEAN, NV
IVANPAH SOLAR ELECTRIC GENERATING SYSTEM

CH2MHILL

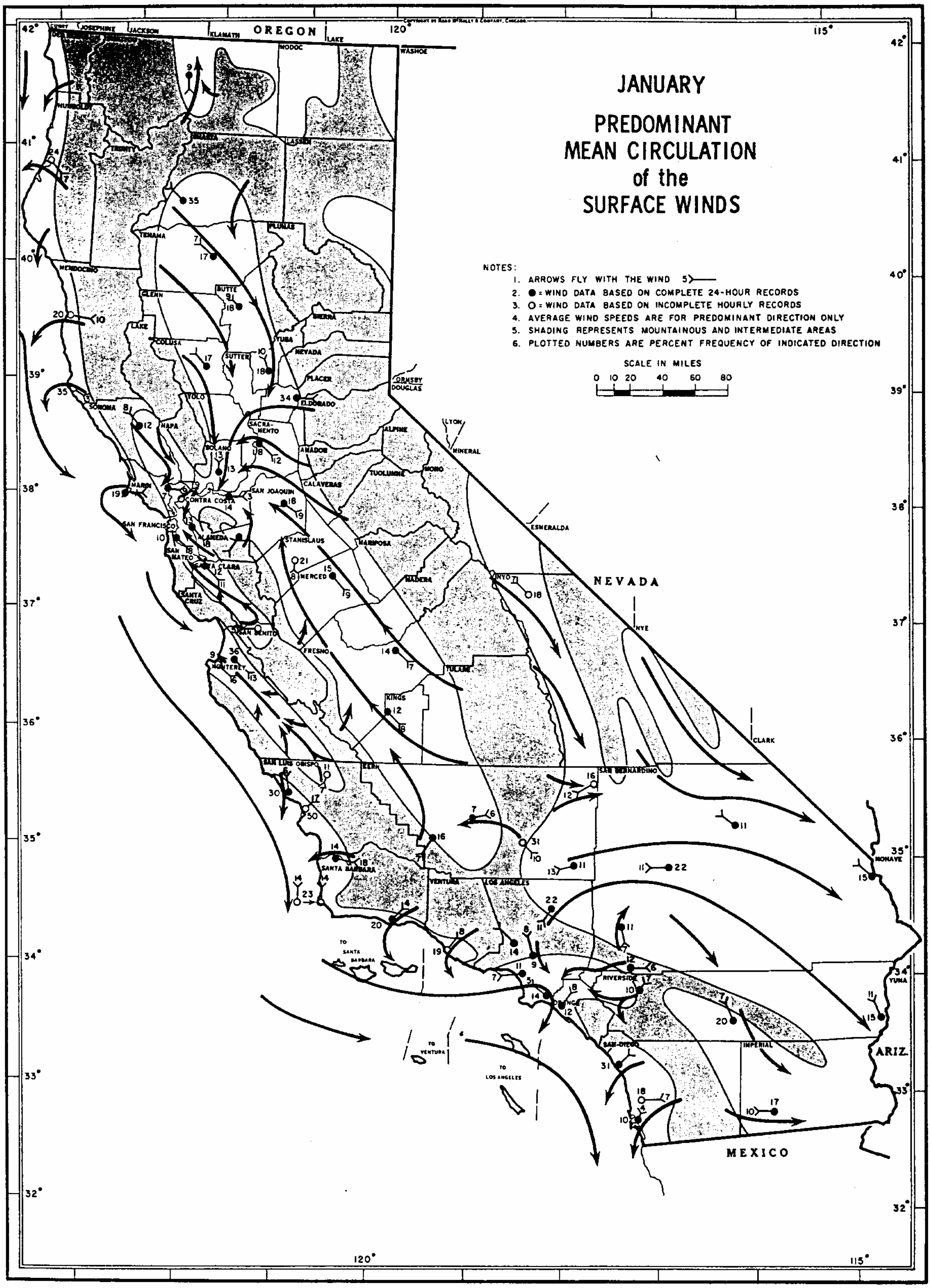

FIGURE 5.1-3
JANUARY PREDOMINANT MEAN CIRCULATION OF THE SURFACE WINDS
IVANPAH SOLAR ELECTRIC GENERATING SYSTEM

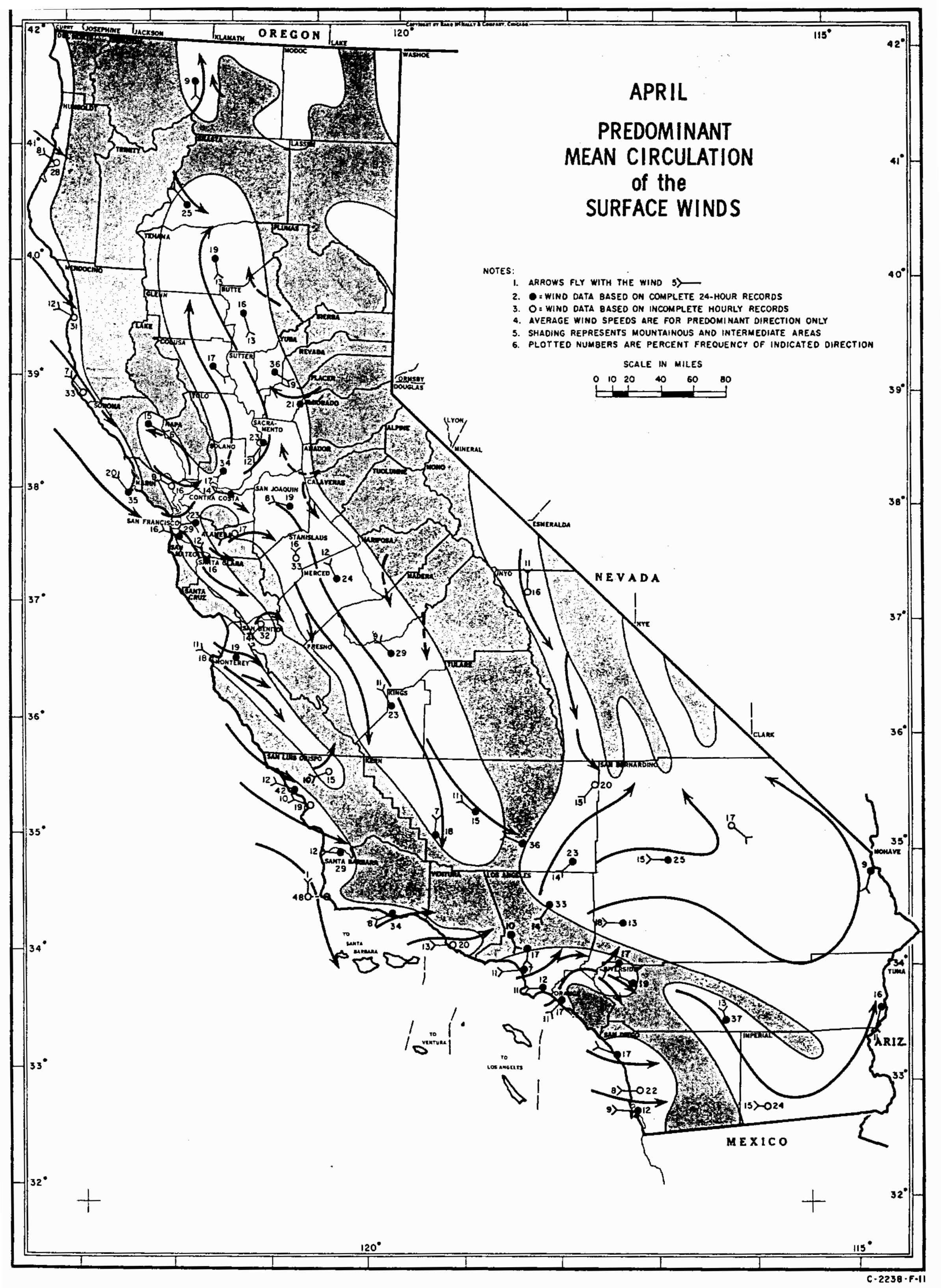

FIGURE 5.1-4
APRIL PREDOMINANT MEAN CIRCULATION OF THE SURFACE WINDS
IVANPAH SOLAR ELECTRIC GENERATING SYSTEM

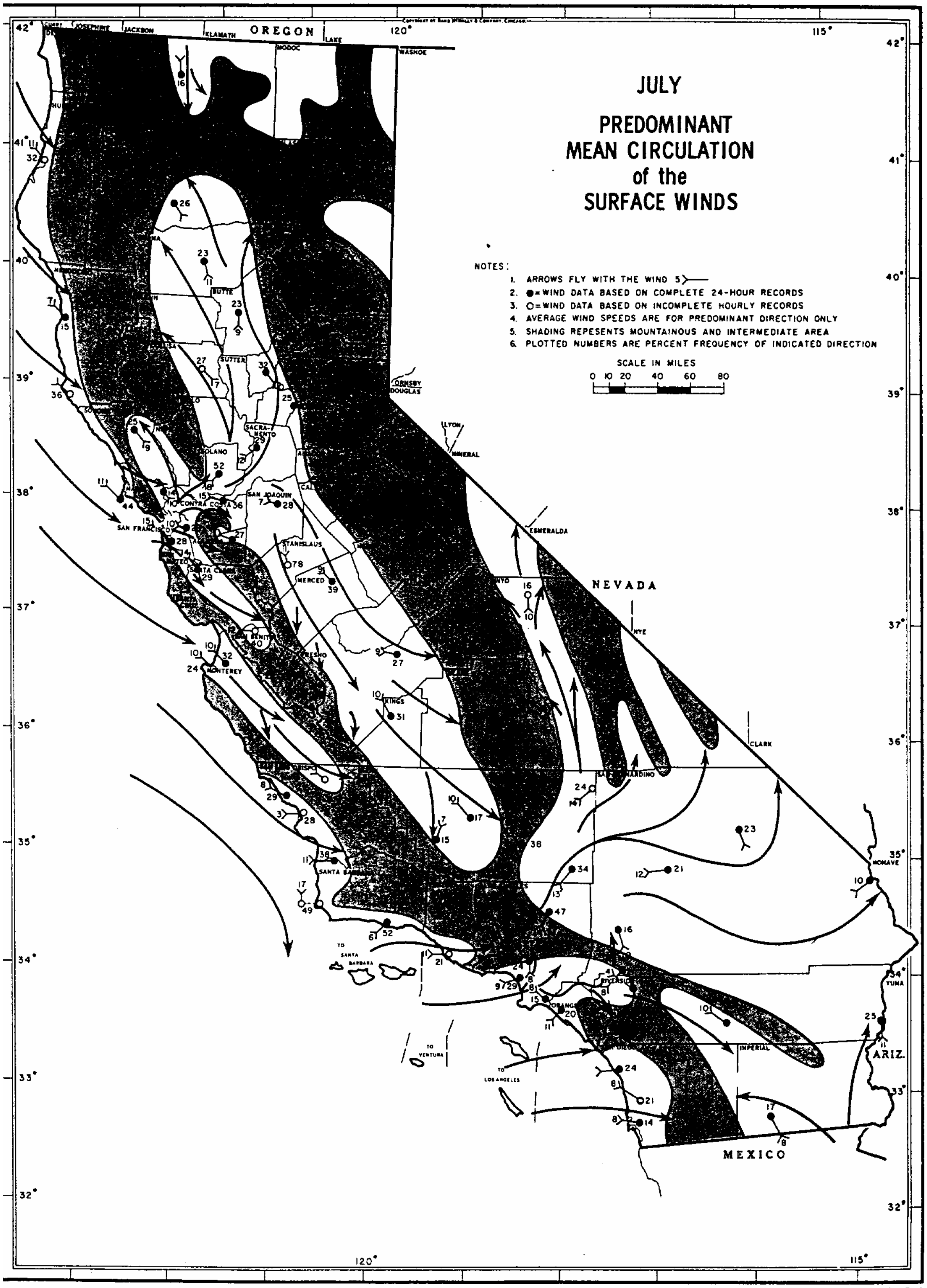

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FIGURE 5.1-5
JULY PREDOMINANT CIRCULATION OF THE SURFACE WINDS
IVANPAH SOLAR ELECTRIC GENERATING SYSTEM

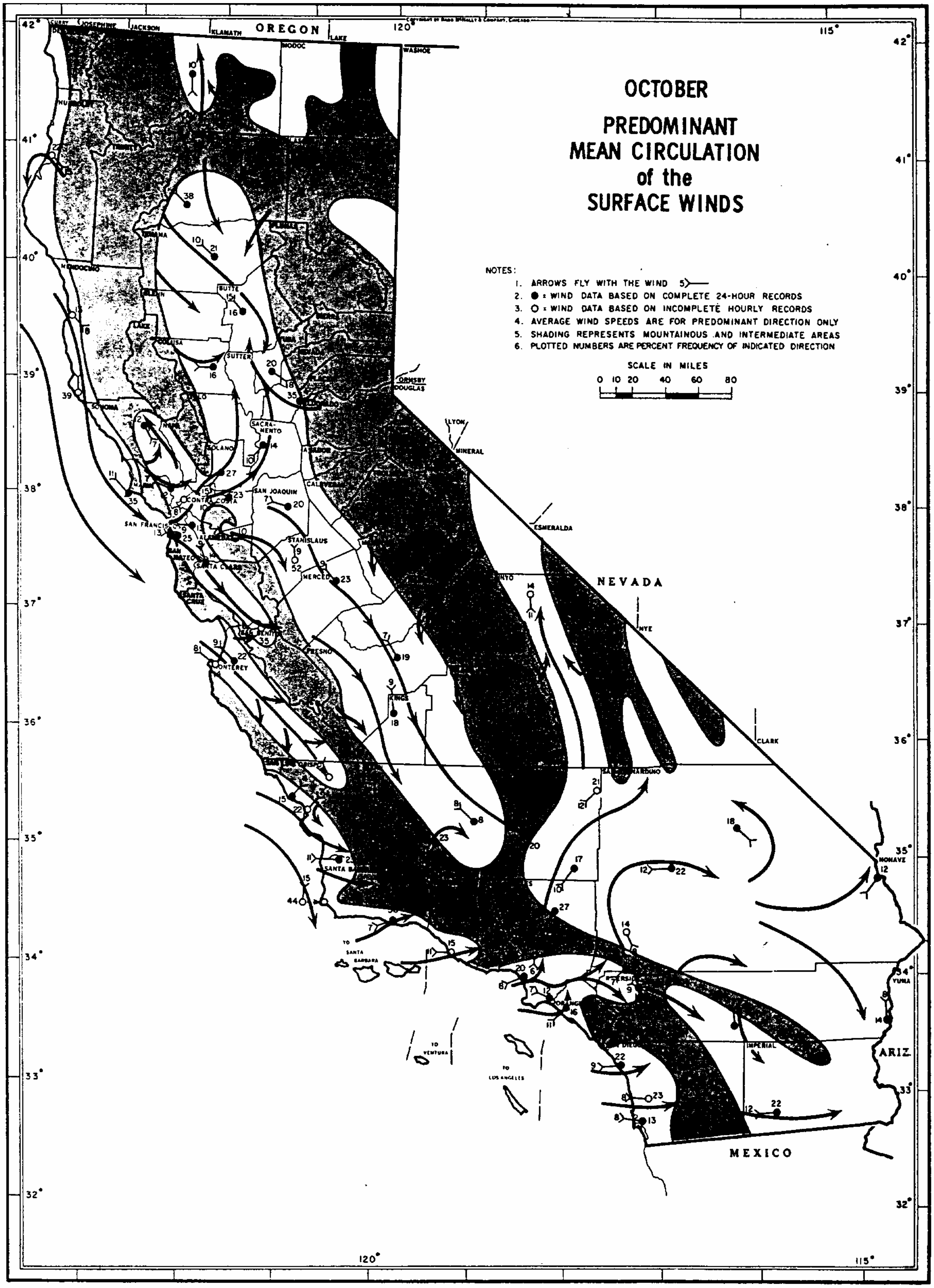
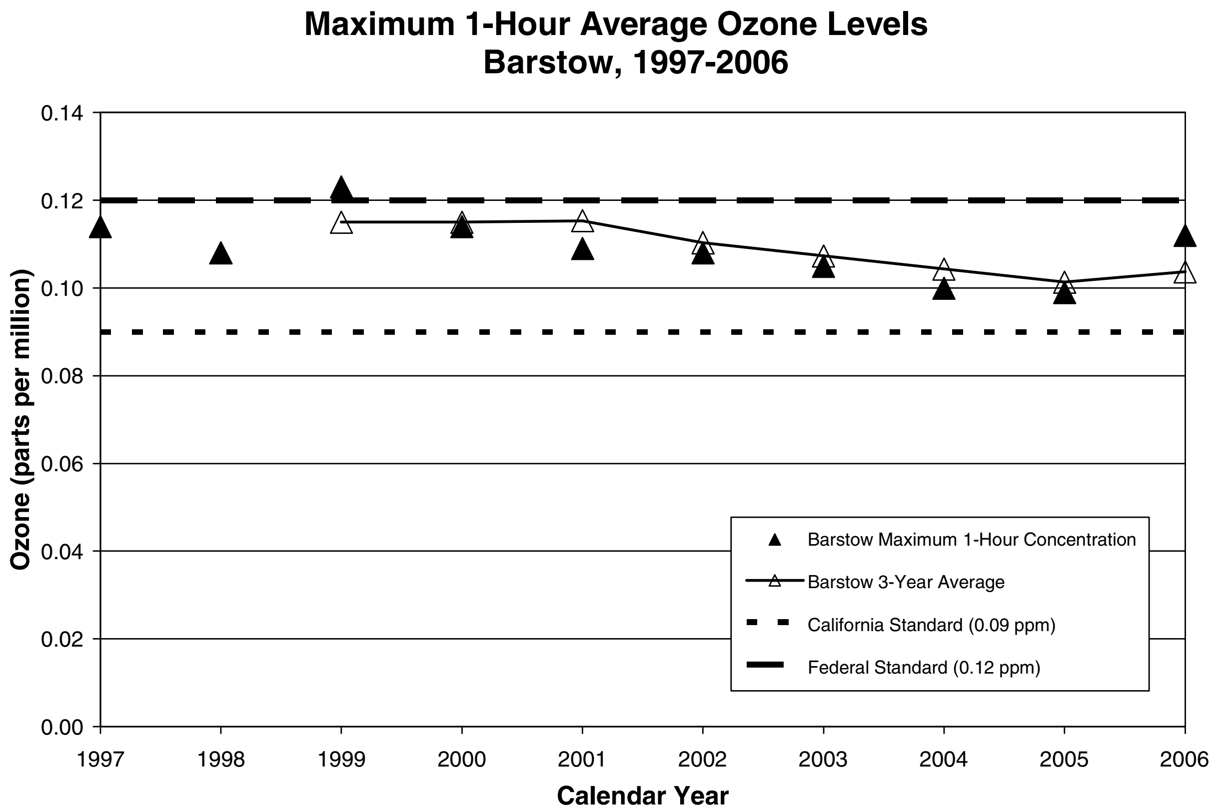


FIGURE 5.1-6
OCTOBER PREDOMINANT MEAN CIRCULATION OF THE SURFACE WINDS
IVANPAH SOLAR ELECTRIC GENERATING SYSTEM



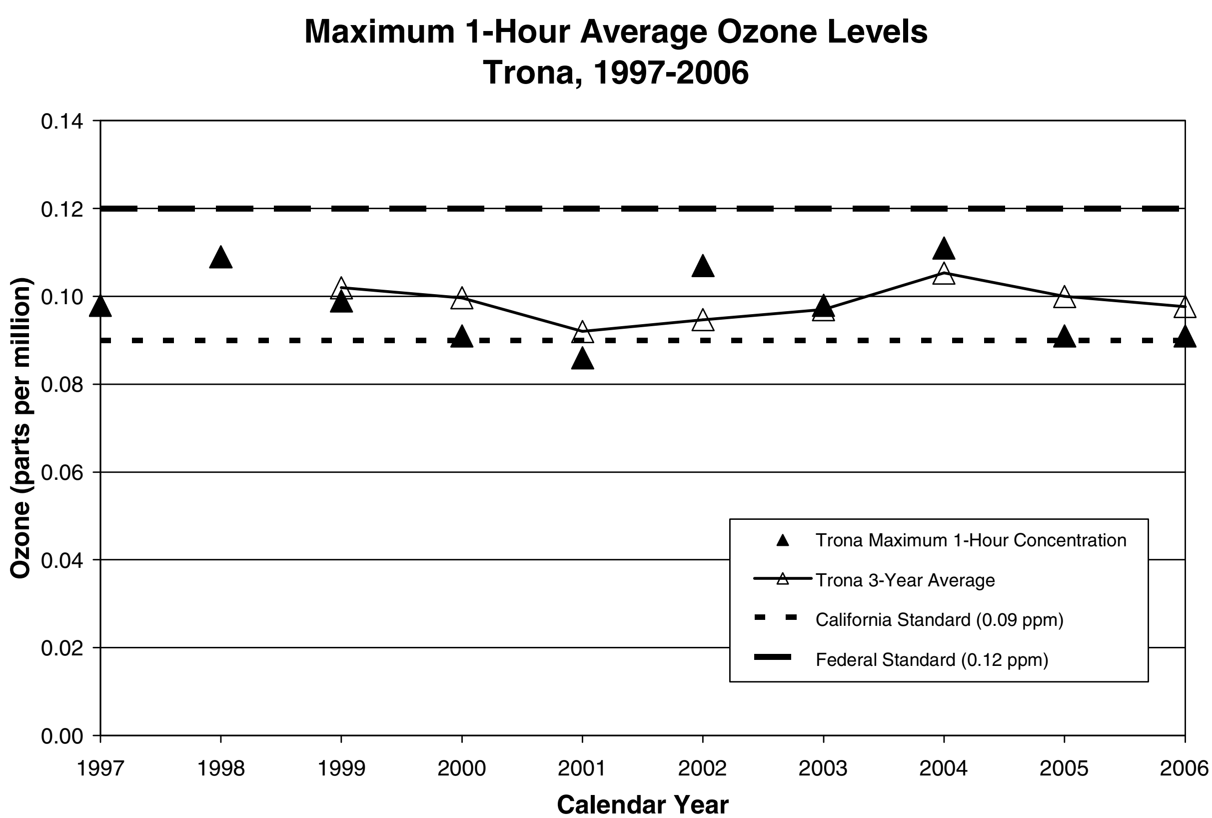


FIGURE 5.1-7
AVERAGE OZONE LEVELS
IVANPAH SOLAR ELECTRIC GENERATING SYSTEM

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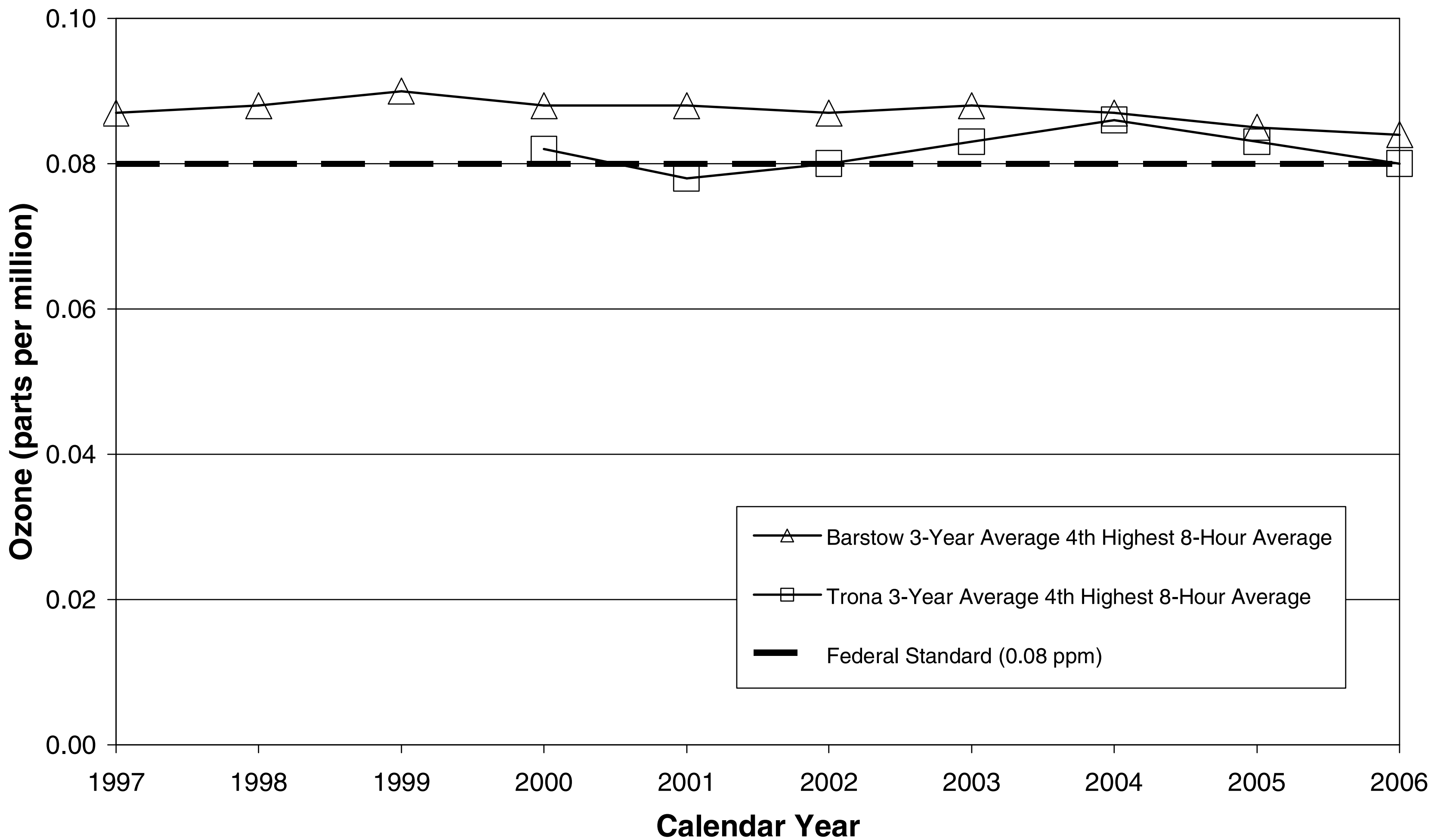

FIGURE 5.1-8
3-YEAR AVERAGE 4TH HIGHEST 8-HOUR AVERAGE OZONE LEVELS, BARSTOW & TRONA, 1997-2006
IVANPAH SOLAR ELECTRIC GENERATING SYSTEM

CH2MHILL

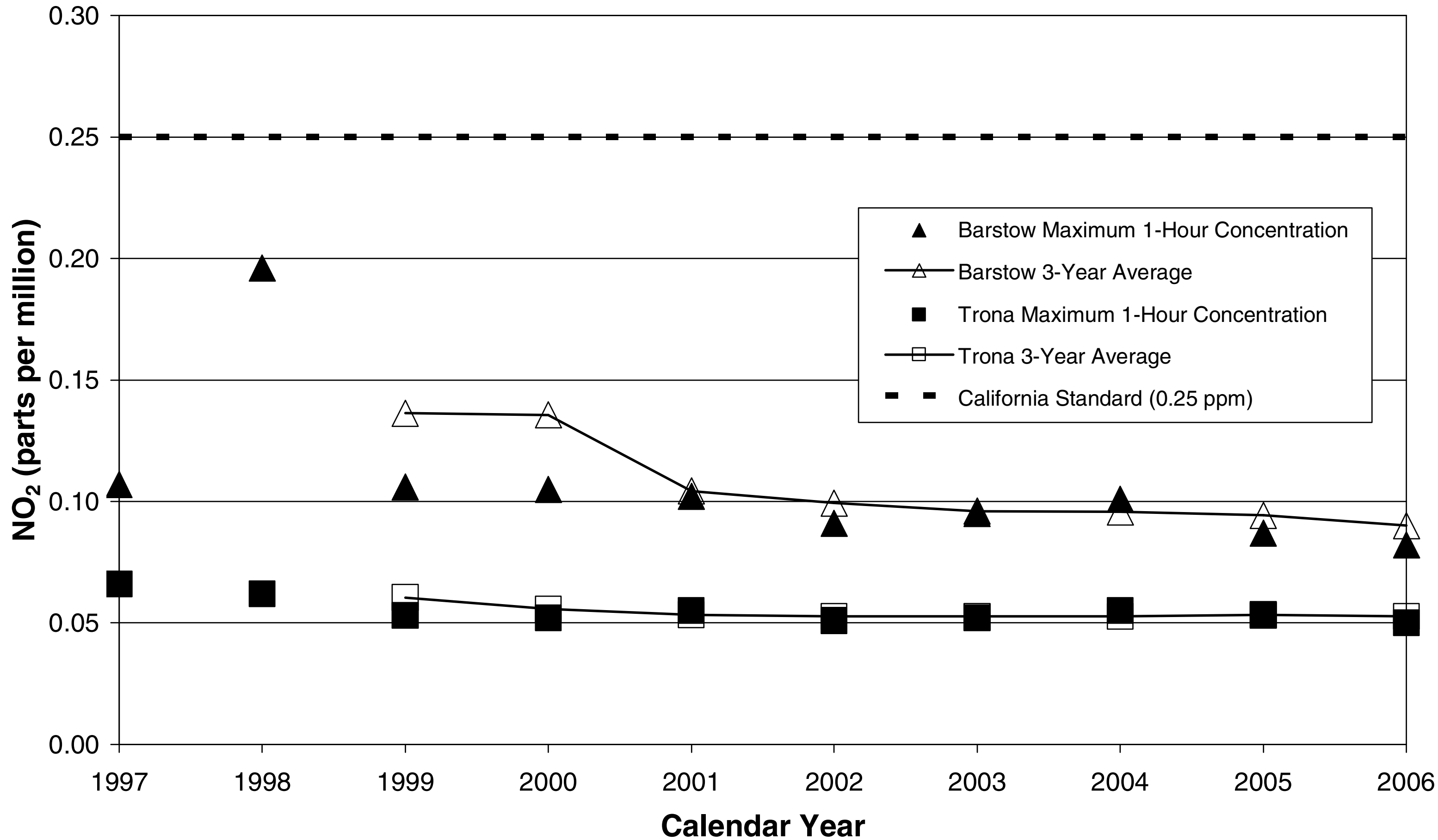

FIGURE 5.1-9
MAXIMUM 1-HOUR AVERAGE NO_2 LEVELS, BARSTOW & TRONA, 1997-2006
IVANPAH SOLAR ELECTRIC GENERATING SYSTEM

CH2MHILL

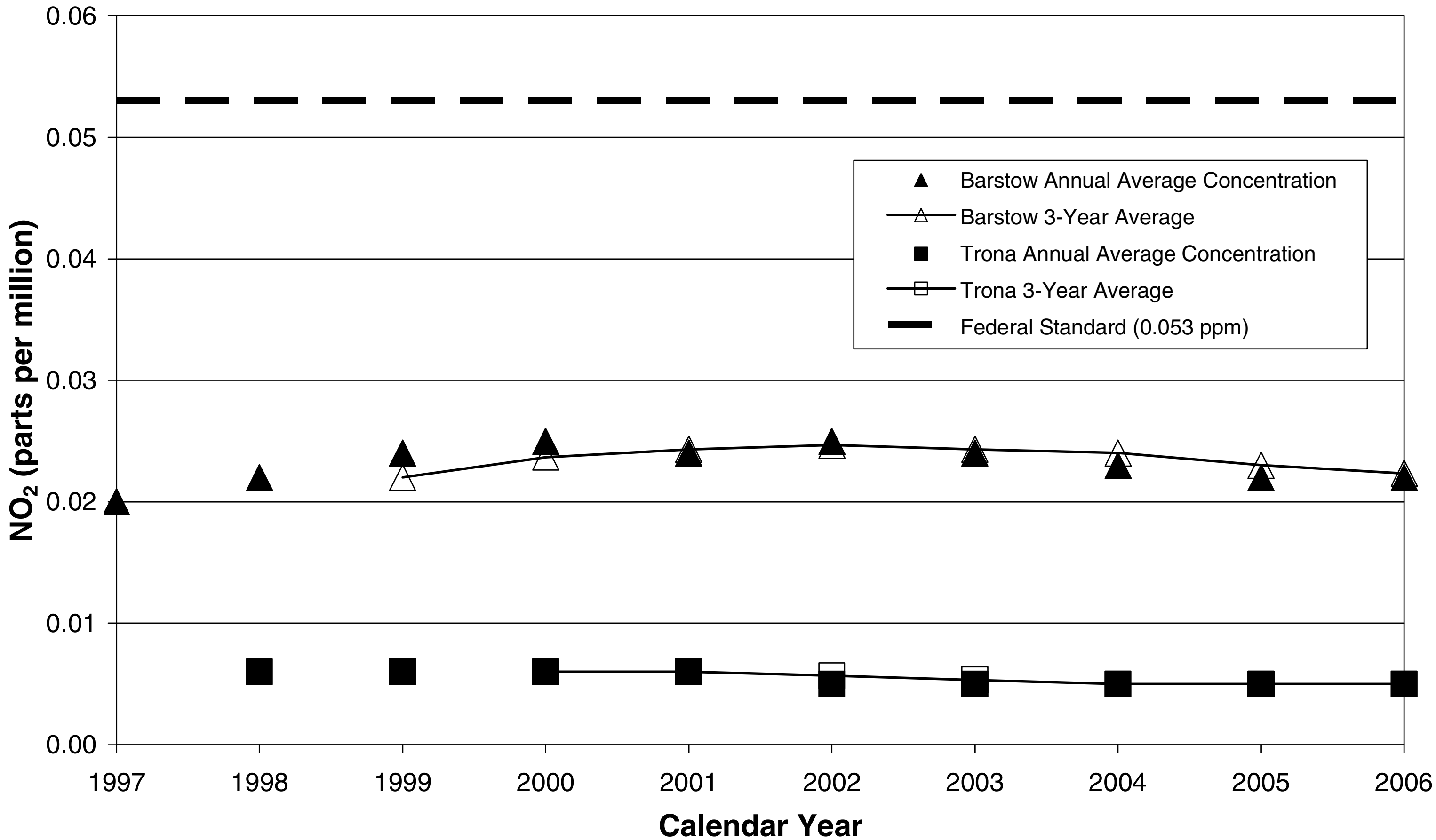

FIGURE 5.1-10
AVERAGE NO_2 LEVELS,
BARSTOW & TRONA, 1997-2006
IVANPAH SOLAR ELECTRIC GENERATING SYSTEM

CH2MHILL

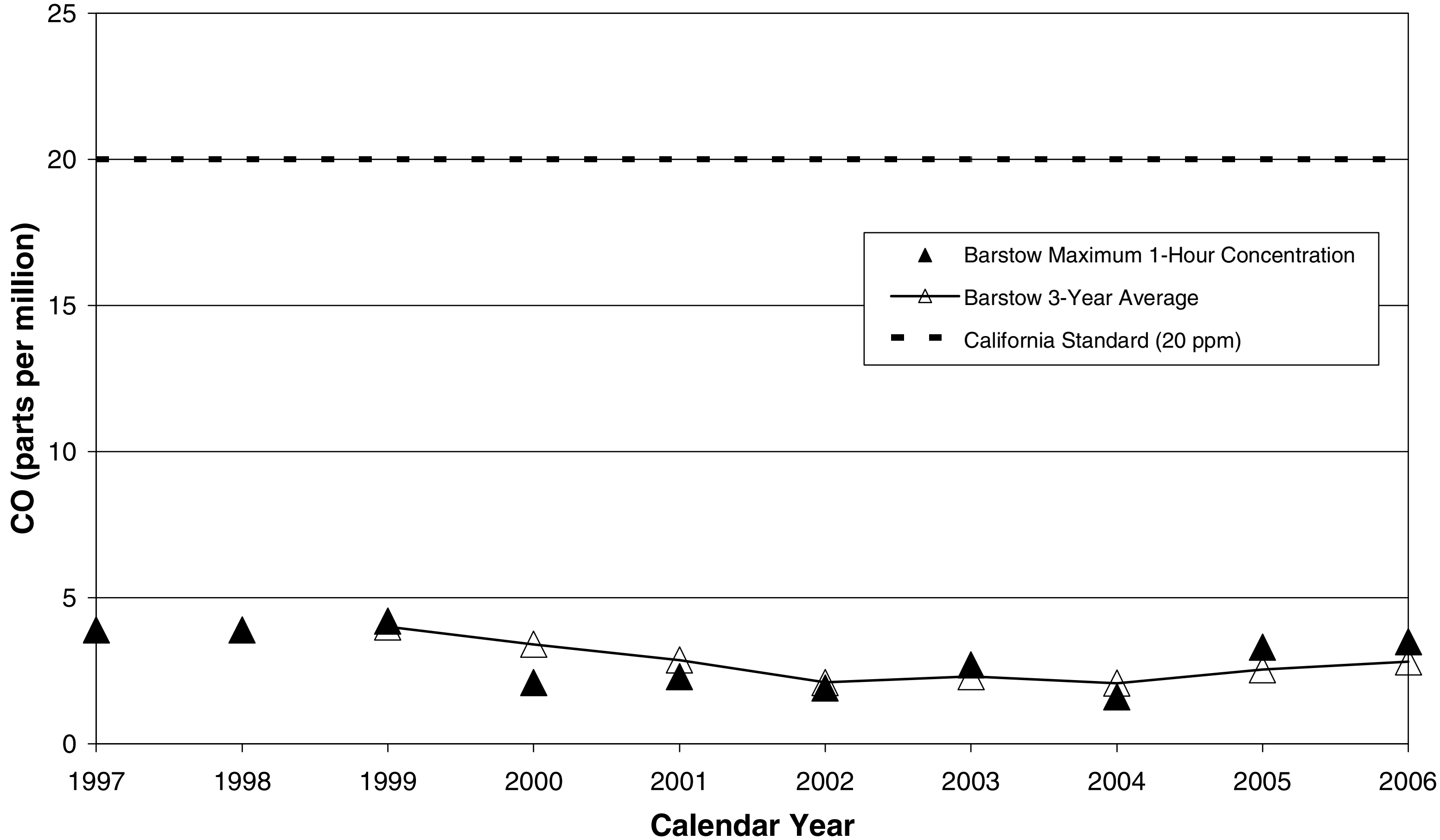

FIGURE 5.1-11
MAXIMUM 1-HOUR AVERAGE CO LEVELS, BARSTOW & TRONA, 1997-2006
IVANPAH SOLAR ELECTRIC GENERATING SYSTEM

CH2MHILL

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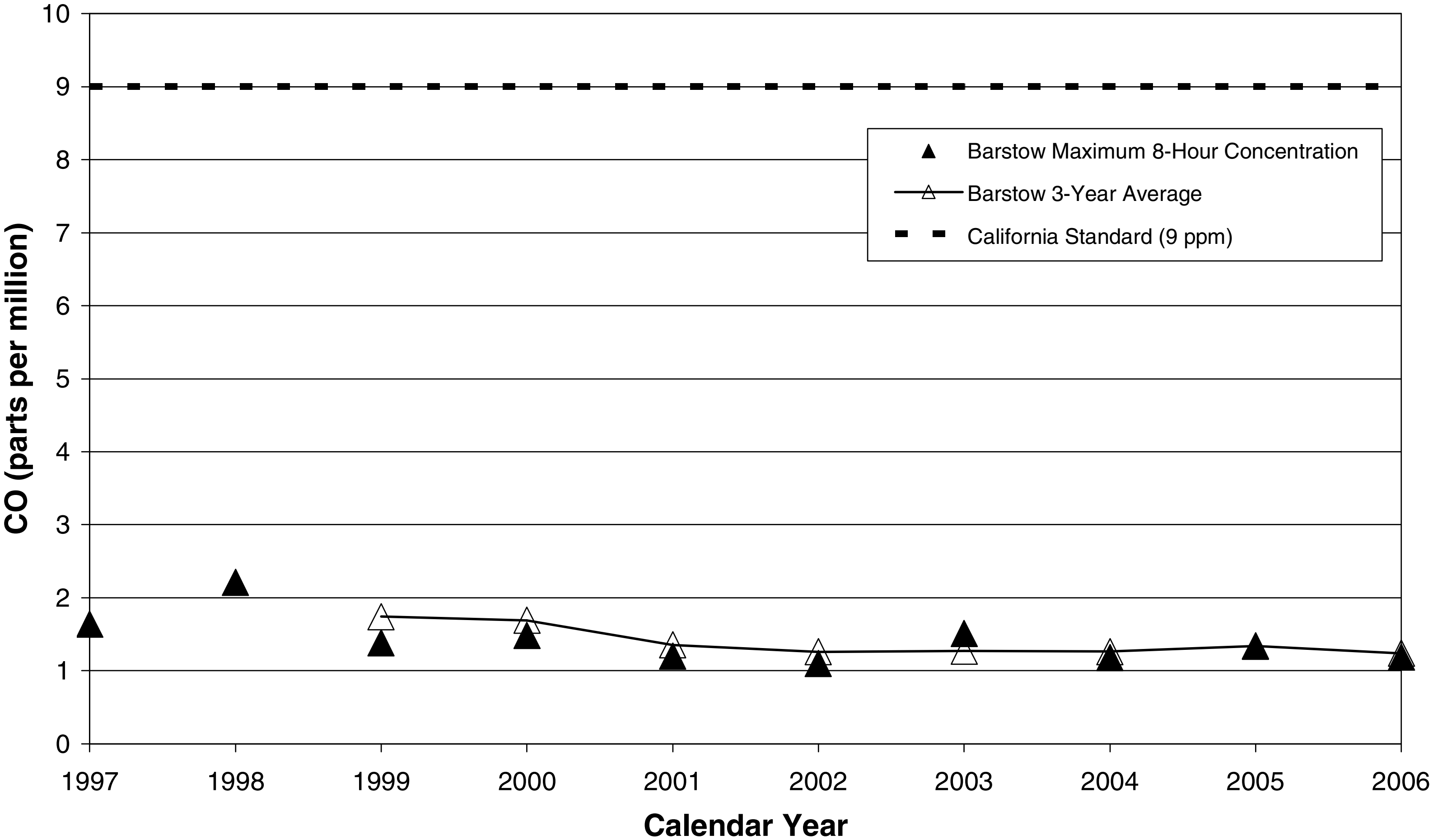

FIGURE 5.1-12
MAXIMUM 8-HOUR AVERAGE CO LEVELS, BARSTOW & TRONA, 1997-2006
IVANPAH SOLAR ELECTRIC GENERATING SYSTEM

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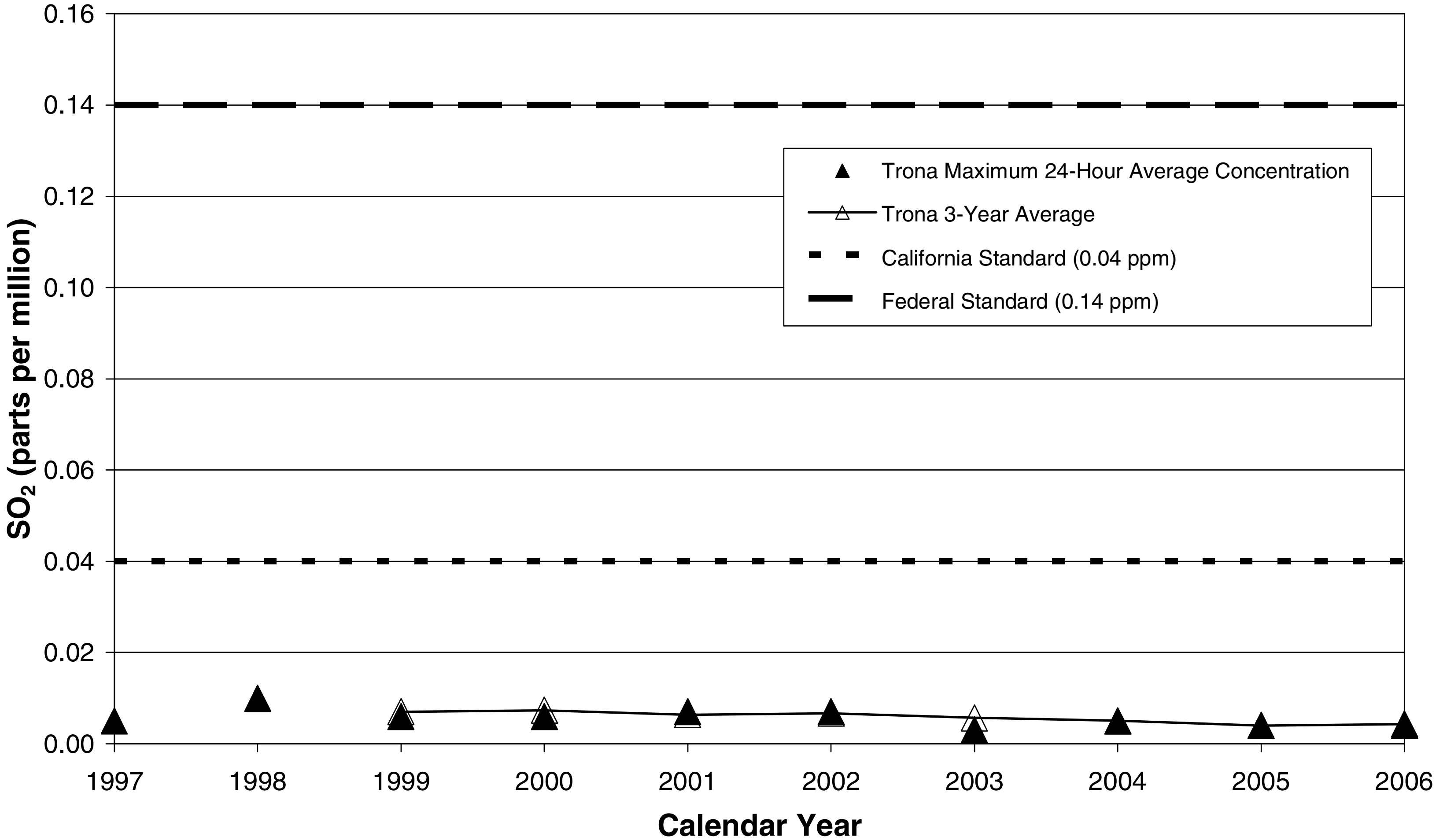
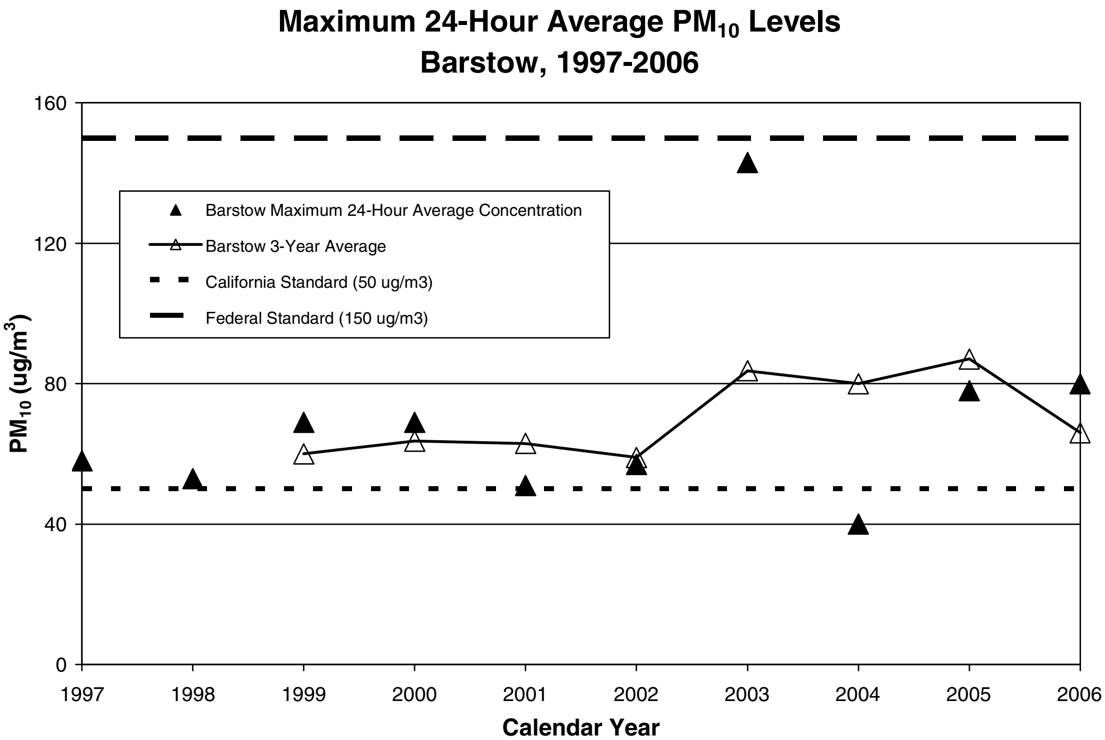


FIGURE 5.1-13
MAXIMUM 24-HOUR AVERAGE SO_2 LEVELS, BARSTOW & TRONA, 1997-2006
IVANPAH SOLAR ELECTRIC GENERATING SYSTEM

CH2MHILL



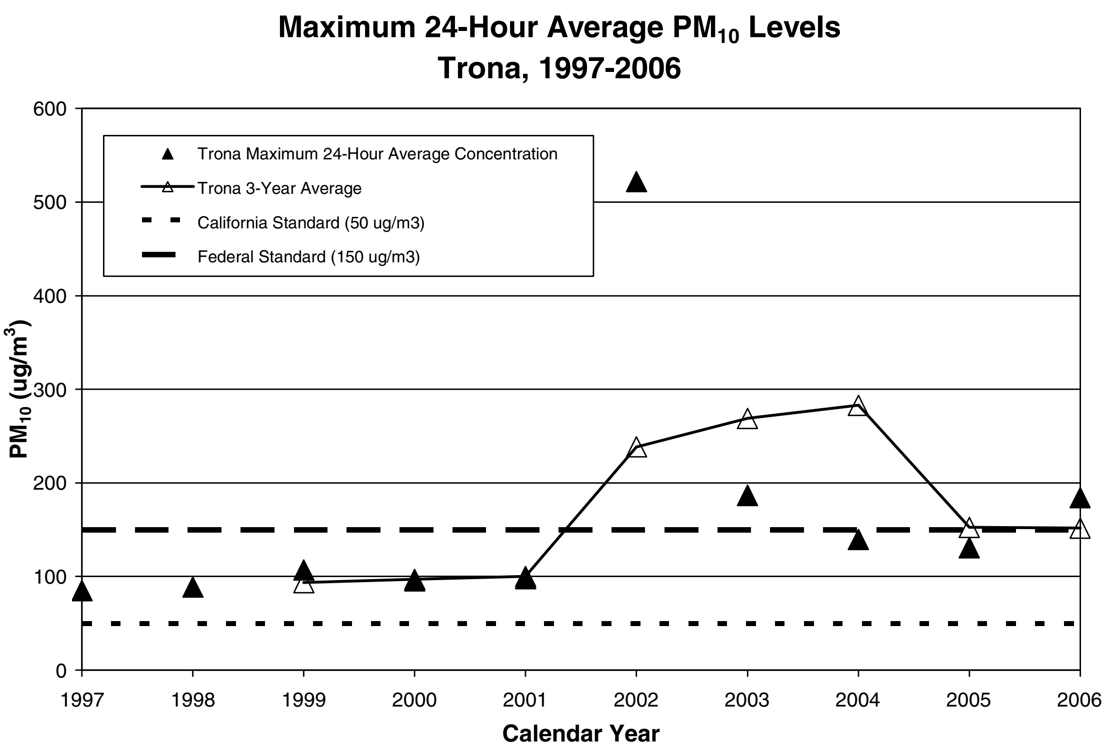


FIGURE 5.1-14
MAXIMUM 24-HOUR AVERAGE PM_{10} LEVELS, BARSTOW & TRONA, 1997-2006
IVANPAH SOLAR ELECTRIC GENERATING SYSTEM

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ES062007009SAC Figure_5.1-14 08/14/2007 afint

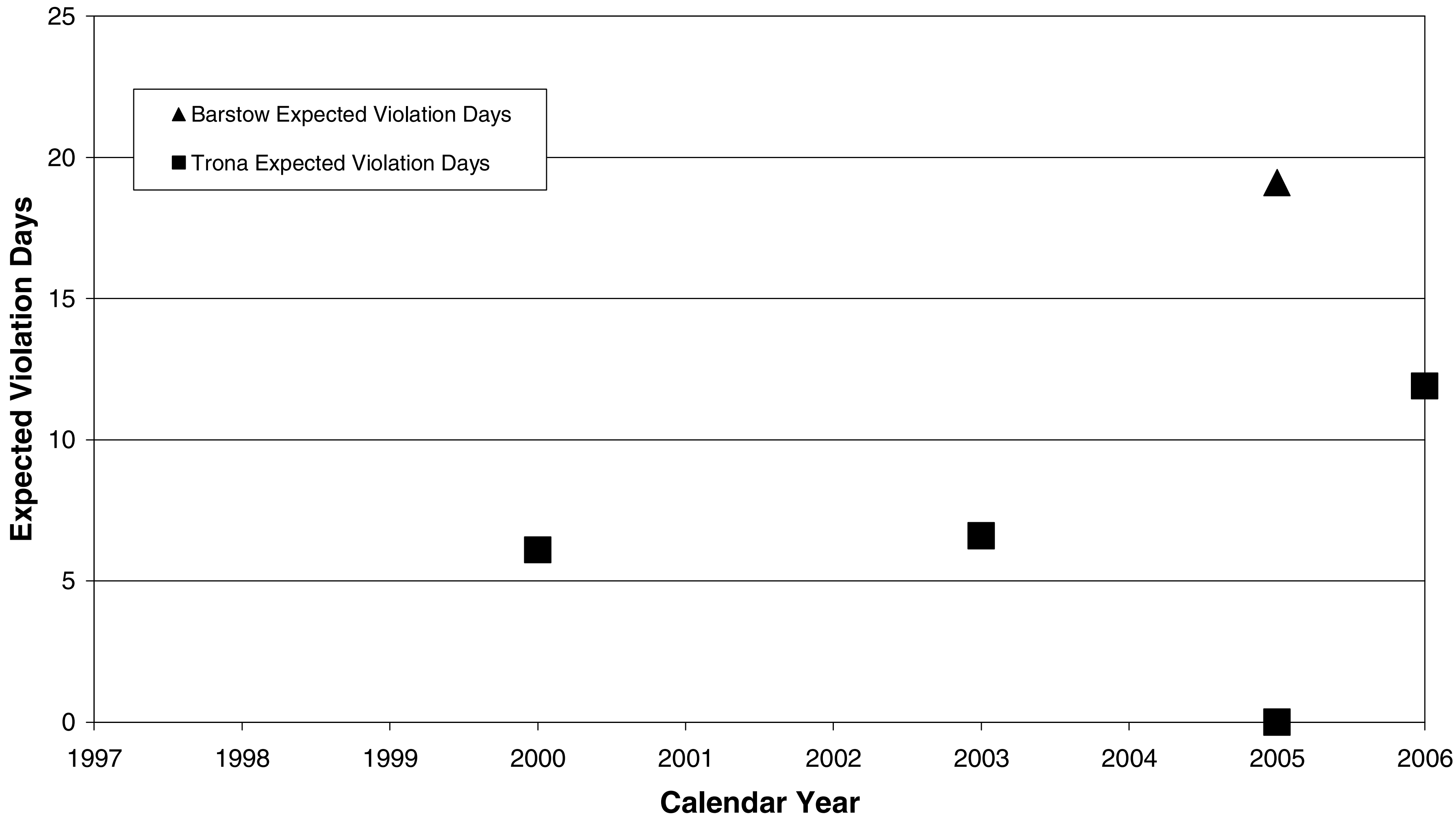

FIGURE 5.1-15
EXPECTED VIOLATIONS OF CALIFORNIA 24-HOUR PM10 STANDARD (50 ug/m^3), BARSTOW & TRONA, 1997-2006
IVANPAH SOLAR ELECTRIC GENERATING SYSTEM

CH2MHILL

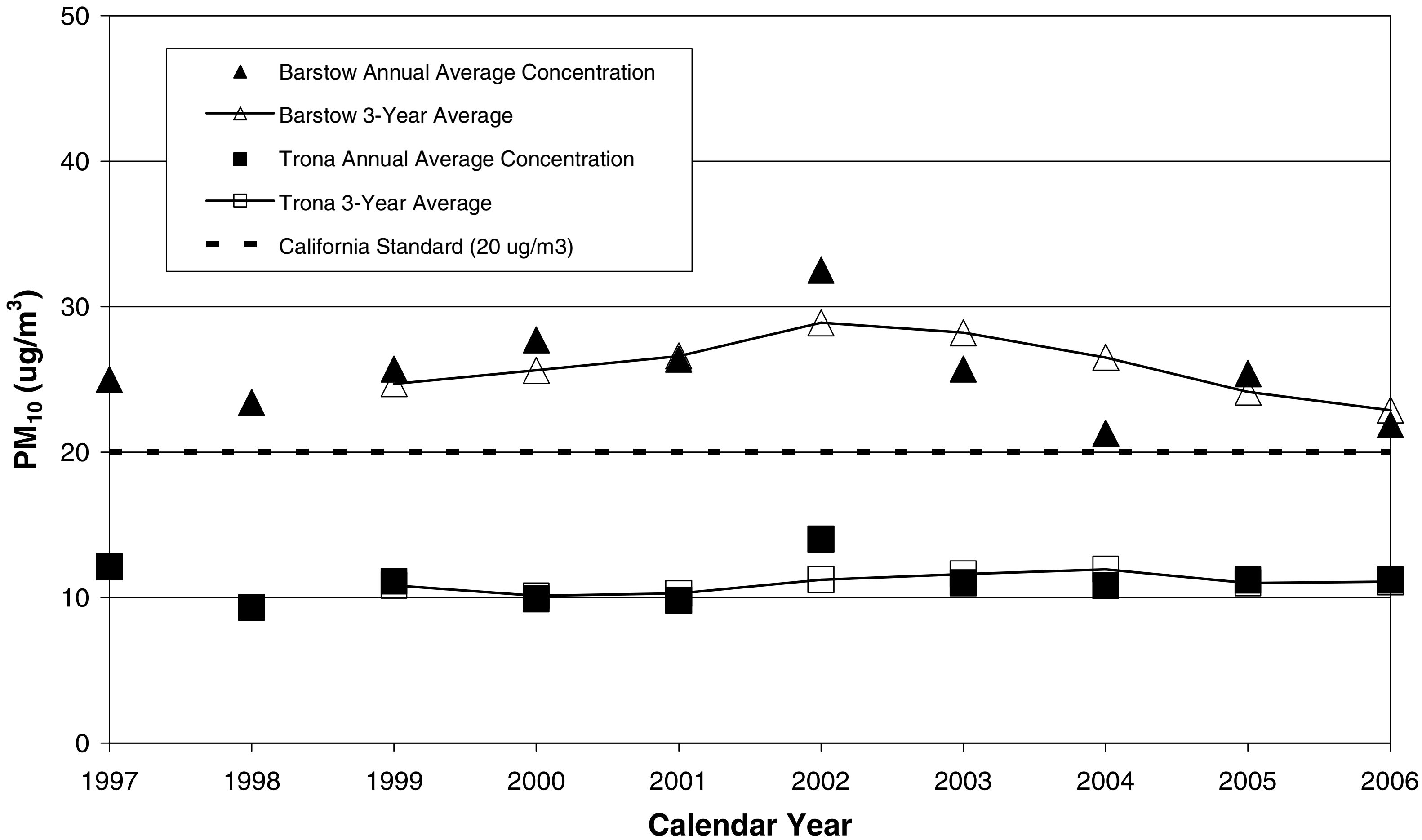

FIGURE 5.1-16
ANNUAL AVERAGE PM_{10} LEVELS, BARSTOW & TRONA, 1997-2006
IVANPAH SOLAR ELECTRIC GENERATING SYSTEM

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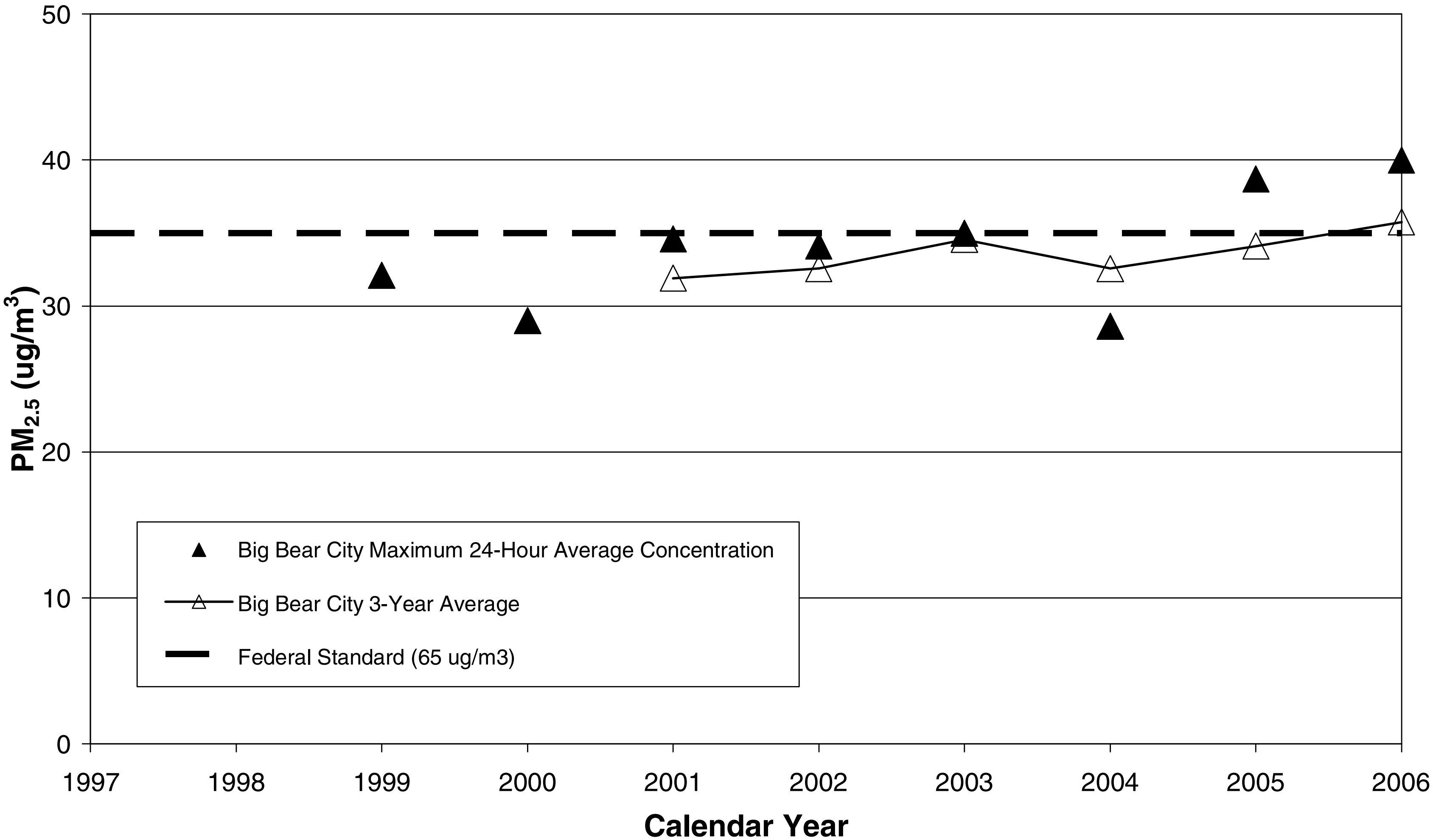

FIGURE 5.1-17
MAXIMUM 24-HOUR AVERAGE
$PM_{2.5}$ LEVELS, BIG BEAR CITY
1997-2006
IVANPAH SOLAR ELECTRIC GENERATING SYSTEM

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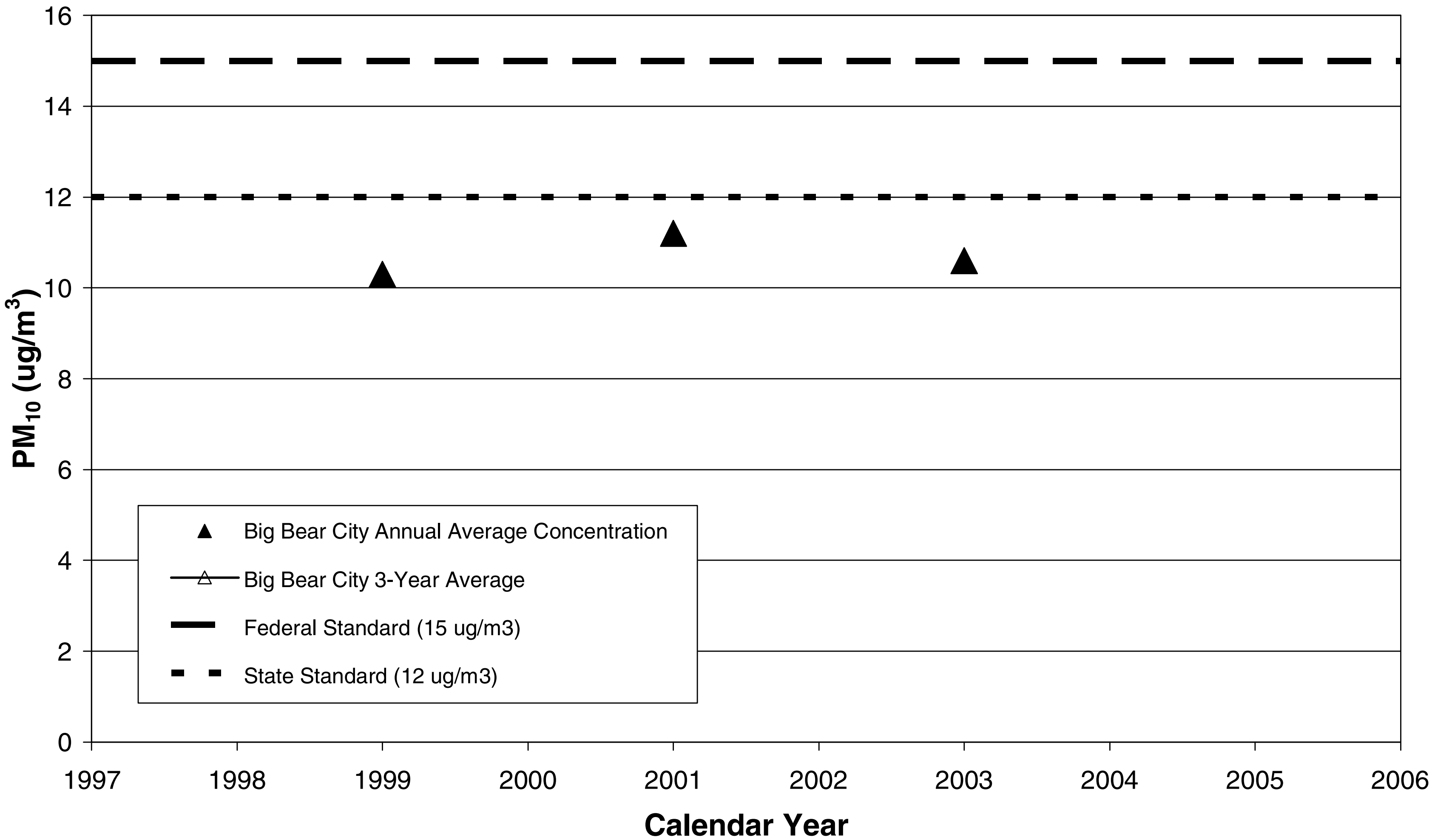

FIGURE 5.1-18
ANNUAL AVERAGE $PM_{2.5}$ LEVELS, BIG BEAR CITY 1997-2006
IVANPAH SOLAR ELECTRIC GENERATING SYSTEM